AGRICULTURAL ENGINEERING

Established 1920

This Journal is owned, edited, and published monthly by the American Society of Agricultural Engineers.

Editorial and advertising departments at the executive office of the Society, Saint Joseph, Michigan. Publication office at Benton Harbor, Michigan.

The A.S.A.E. is a member of
AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE
AUDIT BUREAU OF CIRCULATIONS

SUBSCRIPTION PRICE: $3.00 a year, plus an extra postage charge to all countries to which the second-class postage rate does not apply; to A.S.A.E. members anywhere, $2.00 a year. Single copies (current), 30 cents each.

POST OFFICE ENTRY: Entered as second-class matter, October 28, 1933, at the post office at Benton Harbor, Michigan, under the Act of August 24, 1912. Additional entry at St. Joseph, Michigan. Acceptance for mailing at the special rate of postage provided for in Section 1103, Act of October 3, 1917, authorized August 11, 1921.

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Vol. 25, No. 7

EDITORIAL

Farm Power Studies

THE method of approach to farm power studies set forth in the paper by H. H. Stippler, beginning in this issue of AGRICULTURAL ENGINEERING, deserves the attention of agricultural engineers. While his analysis may be subject to criticism, because many important variables necessarily have been omitted, he has painted with a rather broad brush a picture of actual farm power conditions on farms where it is desirable to know more about the use of energy, including labor, in the production of diversified crops. Mass production of farm equipment has caused agricultural engineers to strike hard at the production costs of machines, without giving equivalent detailed thought as to how the equipment is actually used by farmers. Mr. Stippler very realistically uses actual farm conditions in his method of approach, and he uncovers numerous complex relationships between mechanical power, animal power and labor which require attention in an over-all analysis of farm energy input.

His use of the Nebraska tractor tests is a tribute to the engineering approach, as well as an example of the difficulties and dangers involved in transferring engineering test data to actual field operations. The idea of a conversion factor in translating power and labor operations to a common base is unique in its application and quite sound in basic approach when supported by ample field data. Mr. Stippler's comparison of mechanical and animal power are based on hourly operations and do not take into account the relative power potentialities of a biological power plant as compared to a strictly mechanical one.

It should be encouraging to engineers, however, to have a farm management specialist interested in a method of approach which involves to a considerable degree engineering analysis. His paper, vulnerable as it may be to strictly technical engineering criticism, opens up common problems between farm management and agricultural engineering workers which, if studied cooperatively without prejudice by either group, afford vast opportunities for the development of much needed technical data. It is to be hoped agricultural engineers will study Mr. Stippler's method of approach with a view to furthering and improving cooperation in such areas of mutual interest.

H. B. WALKER

Country Doctor and Country Squire

DURING his year as president of the American Society of Agricultural Engineers, his extensive travels in behalf of the profession and the Society, his balanced and critical contacts with its varied phases and objectives, and his position as head of the profession in its relation to other elements in the American scene, all gave to Past-President Arthur W. Turner a peculiar perspective to inspire his presidential address at the Milwaukee meeting. As a comprehensive message on the state of agricultural engineering and its place in the nation, it deserves careful study. It appears elsewhere in these pages.

We are particularly impressed by his plea for more extensive interweaving of our work with that of other agricultural workers—agronomists, geneticists, animal husbandmen, etc. — especially in the realm of research. It seems significant that the same plea was developed, from a quite different background, by G. B. Gunlogson in his address at the same meeting, to be published in a later issue. Both point to the perils of specialization which falls short of adequate articulation into all the allied areas of agriculture, and indeed of the national economy. Both urge what the one calls the "country doctor" idea.

All this only means that our profession must grow more fully into the destiny for which it was born. There was no lack of architectural, civil, electrical, hydraulic, and mechanical engineering, but there was a dearth of men and means to apply them in agriculture. In our first thirty-seven years we have made a good start, but we still are far short of giving and getting that complete cooperation which will best serve agriculture and America.

Likewise we are impressed by Mr. Turner's exhortation toward civic leadership and the cultivation of spiritual values. Again we are reminded of similar suggestions by other of our presidents, notably Arthur Huntington. Both in our education and in our subsequent evolution we have the right and the duty to develop cultural values exceeded by no one. With our feet not only on the ground but actually in the soil we stand firmly on reality. We may not have our heads in the clouds, but we have at least the stature for vision to broad horizons. If we default in our duties of leadership, we can hardly complain if others are eager to exercise them.

In his reference to the fact that the findings of agricultural research must pass through the hands of manufacture before they assume practical value for the farmer, Mr. Turner simply states the obvious. Yet it is a fact too little appreciated. Demagoguery has too much tried to make it appear that those who serve the farmer are his enemies and exploiters. In these human and economic relations, as well as in matters technical, the agricultural engineer has an educational duty. Increasingly he becomes a contact man between the farmer and the preponderant population in industry, commerce and trade. As an apostle of understanding he can be comparable not only to the country doctor but to the country squire.

Common Denominator

IN HIS paper presented to the Southeast Section of the American Society of Agricultural Engineers, published last month in these pages, Fred W. Knipe pretty well proved his point that the agricultural engineer is a "natural" for the engineering aspects of malaria control, and especially for weaving such control into the pattern of agriculture and of rural living. His well-nigh world-wide experience in that special field would seem to make him an authority in it. His record of a quarter century as a member of the Society likewise implies perspective in his view of the profession.

Perhaps in passing it deserves mention, considering the proletarian trend of the times, that the work he is doing, the vision and the humanitarianism which inspire it as well as the funds which finance it, all have as their source the success of a man who founded a great industry as well as a great fortune. It challenges the easy assumption that profit is antisocial *per se* and that personal control of great wealth is an unmixed evil.

The point which impresses us, however, is the unique place of agricultural engineering as the profession which correlates and consolidates such seemingly unrelated matters as malaria control and the humdrum business of farming. When we likewise consider the effect of the contour concept on such remote effects as the continuity of water power and the flooding of cities hundreds of miles downstream, and of dozens of other interrelations *(Continued on page 261)*

AGRICULTURAL ENGINEERING

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Agricultural Engineers—Pioneers of Tomorrow

By Arthur W. Turner
Fellow A.S.A.E.

ARTHUR W. TURNER
President, A.S.A.E., 1943-44

WE ARE assembled for the 37th annual meeting of the American Society of Agricultural Engineers, the third held during this war. Each succeeding year has witnessed unusual and unexpected events, yet through it all our Society has grown in membership, activity and service. We are realizing the mature responsibility of our profession. That is a remarkable tribute to the founders and pioneers of agricultural engineering and our Society in building on a firm foundation. We have been tested and have proven that we are going on to win greater achievements and to create greater opportunities for our noble members now serving in the armed forces.

I could recite the achievements of individual members and groups of members. That is history. World events are moving so rapidly today that it seems advisable to look ahead, realize our opportunities and our responsibilities, and plan our program to meet them.

In discussing these responsibilities I realize they deal with subjects which permit differences of opinion, so I want to say right now that they are expressions of personal beliefs or convictions and are not the opinions or expressions of the Society or any group or organization.

War in its stark realism is a destructive process. This is most evident on the field of battle. Its casualties are not confined to the broken bodies of men in actual combat, to the twisted wreckage lying on the bottom of the sea and to the blackened and barren ruins of military objectives. It leaves its mark on everything with which it comes in contact, even thousands of miles away from conflict areas. This war involves all of mankind and its institutions.

The effects of the war are not all evident. Many elements of destruction even tend to be insidious. Some of us may look upon retrogression as progress, especially if in our snap judgment we fail to appreciate that many measures we have taken to win the war are the reverse of civilization's progress.

During these grim days the youth of the world may have those years of blossoming adulthood snatched away from them. Dean Dougherty of the University of Tennessee says: "College education is a magnificent interlude between adolescence and young manhood; it is the prelude and first degree initiation leading to professional practice." That interlude is denied today's youth; those years when high school graduates and college students plan and prepare for permanent and constructive life work, when families are being founded and homes established. In their stead the grim realities of war are forming the pattern of tomorrow.

Is that the picture of advancing civilization? Is that the result of hundreds of years of improved education? Is that the constructive picture of engineering? Surely not a pleasant picture to face, yet we as engineers and citizens have no alternative.

Can this war be, in part, the result of the work of specialists, whether national, racial, professional, religious or political — specialists so interested in their own interests that they become isolated from all others? Have we had the wrong viewpoints and objectives, or have we buried ourselves in our own little jobs or niches? Have we in reality become isolationists to the point that we are unable to understand the ramifications of civilization and its interlocking relationships? I recall George Russell's comment on a renowned scientist: "He is not really intelligent for his mind embraces little outside his profession. A candle does not shine in only one direction."

The tendency for specialists to become isolationists reacts in two ways: First, the specialist may be so all-absorbed in his profession that he neglects to inform others of his talents, his training and his abilities, so that when emergencies arise, leaders of the moment do not call on him for his contribution. Second, the specialist can become so saturated with the importance of his profession or group that he becomes egotistically all-powerful in his own mind. When confronted by an emergency and his policies fail, he grasps in panic, like a drowning man, for any straw. Examples are repetitive, generation after generation and country after country. Leaders, self-styled or otherwise, continue to promise millenniums, unmindful as ever of man's inability to unify subjective and objective nature.

Let us be realistic about our America and the world. Our young folks of today, those who should be experiencing that interlude of college life, are training to kill and destroy. The fine art of living has been replaced by the brutal art of killing. Our government following in the footsteps of some other governments has permitted the military to black out all else, and it is of course expedient that we win this war and do so as quickly as possible. It is equally important that we be prepared to enter into and promote a sensible, practical and lasting peace for mankind. Can this be done without foresight, planning, and training? E. Stanley Jones, eminent Methodist missionary, preacher, and writer says: "A lack of intelligent planning makes us prisoners of today instead of the pioneers of tomorrow." What is our training today? It is to hate, destroy, kill. Every able-bodied youth and man of 18 years of age and older is training for or already engaged in war. Where is there a constructive program of selection and training for peace?

Leaders of the Big Four nations are discussing postwar patterns for the world. The June 9th (1944) issue of the "United States News" reports on one of the more prominent plans as follows: "Police power would be exercised under the authority of the United Nations Council, which in the event of trouble would call on one or more governments to act." Not much different from previous pacts, where force seems to be the theme for peace as well as war. David Lawrence stated in that same issue: "What good are treaties and pledges if we do not have men of character in public office to enforce them?" How will such men be available unless we train them and train them NOW?

We are now 100 per cent a war-minded nation. No thought, no plan — apparently only hope — for the future. This means we will be "prisoners of today" and some nation — maybe an ally, maybe an enemy with its eye on the future — is planning and preparing to be "the pioneer of tomorrow's civilization." History records many such cases. Is America blind to this situation?

Let's look at the Germany of 1918. Four years of active warfare combined with the preceding 4 to 5 years of military training deprived the youth of 8 or 9 years of constructive training. The

Address of the President of the American Society of Agricultural Engineers before the 37th annual meeting of the Society at Milwaukee, Wisconsin, June, 1944.

Arthur W. Turner is educational adviser, International Harvester Co.

result was a nation-wide gang of men trained only for killing and destroying everything. Those of the allied nations who granted Germany an Armistice did nothing to correct that situation through education, training and planning. So the murder pack grew, and again it threatens civilization. Lawrence comments on that as follows: "What we need is not so much to focus our minds on rewriting the pledges and covenants of 1919, but to study what happened (in Germany) from the time Hitler came into power to September 1939."

Is there danger of America emerging from this struggle with a similar situation? She might if we do not succeed in convincing our national leaders of the need *now* of planning and training for peace. We may even provide the nation-wide gang for a power-mad leader from some other country. Reviewing events of history, even during the last decade, you are at liberty to guess from where such a leader might rise.

It is important that our national leadership should think beyond winning the war and should plan and train leaders for constructive peace. It is the responsibility of every organization, social and political, to get behind a program that will select and train men and women for the job of formulating peace. Our colleges and universities are well situated to do such a job now. A group thus trained might then provide constructive outlooks for gainful employment for those millions of men and women who are now helping to win this war.

Is our Society one of those organizations? Definitely so. The engineer plans and builds. You and I have the responsibility to reach beyond our spheres and help to lead others toward that objective.

Thus our first responsibility is to broaden this nation's viewpoint to one of planning and training leadership and programing the peace to follow the war.

AG ENGINEERS ARE ENGINEERS OF FOOD PRODUCTION

One essential factor in maintaining peace after the smoke of battle has rolled away and a peace program agreed on is food for a hungry world. To provide it is a major problem. As agricultural engineers we are the engineers of food production, so perhaps it is *our* problem. Many world students tell us that the foremost interest of every family in the world is food, closely followed by clothing and shelter. The hungry man with a hungry family is not likely to be concerned with the problems of world federation. He will follow any leader so long as he is promised food.

Such situations are not uncommon today. The re-occupied countries are demanding food. They will need food to be true patriots of the allied nations. We hear reports that the natives of some of the lands retaken from the Germans do not have as much food now as under previous occupation.

Some of our government planners seem to believe that food can be brought forth from any land by the mere asking. Our military seem to have the same idea for they appear not to realize the importance of trained personnel and the time element in producing food. Neither now nor before the outbreak of war did those in high places fully realize that agricultural science and primarily agricultural engineering can prepare the ground and equip farmers to increase production. Perhaps we were somewhat at fault, if we have let our specialization isolate us from the planners.

We, as a nation, let the era of plenty — plenty here in America — blind us politically and socially to the needs of the world. We were intoxicated with food and unable to recognize the howling of the wolves at the doors of the starving nations of the world. Someone has said that, if no plans are made in advance, expediency of the moment will rule and we can expect a period of futility and frustration. We have seen that picture in many phases of allied activity, but nowhere as pronounced as in the efforts to produce food in the foreign lands. Many persons given those important assignments seem to act on the theory that food production can be multiplied in quantity by merely shipping tractors and farm machines to the foreign lands. That is hardly the entire answer.

One of our members, Major Truman Hienton, writing from the Near East says that the natives prepare the soil with a crooked stick pulled by oxen. He said further that they are not doing such a bad job. The native and his ancestors have been doing this for centuries and they see no reason why they should change. Will mechanized equipment and streamlined farming increase production overnight there or even in countries less primitive? It might, *if* the land was laid out in sizes and shapes to accommodate our type of equipment — an engineer's job. It might, *if* the land had the proper contour to permit the use of our mechanized equipment — an engineer's job. It might, *if* enough capable people accompanied the goods to train the natives how to use and maintain the equipment — an engineer's job. It might, *if* additional water, through irrigation, was provided — another engineer's job. These *ifs* are based on the premise that the same crops could be grown on those lands that we produce in volume here. That we do not know.

And that is only the growing of the crops! How about livestock, poultry, and dairy products and facilities for producing them? Crops, fruits, vegetables, animals and animal products will need to be processed, stored, and preserved until transported to where they will be consumed. All are jobs that the agricultural engineer is experienced in doing.

Returning to the matter of providing additional water through irrigation. In the tropical or semitropical lands malaria and other insect-carried diseases become epidemics if sanitation procedures are not practiced. The agricultural engineer appreciates all the technical phases of farm sanitation — field and home.

It is obvious that producing food is an engineering task. It calls for agricultural engineering in all four of its branches, soil and water management, rural electrification, crop storage and animal shelter, as well as food-producing machinery and transportation facilities. Cooperative advice is desirable from the entomologist, agronomist and animal husbandryman. It is in the main an engineer's job.

Wheeler McMillen made this statement before our annual meeting just a year ago: "Poverty, the lack of food and goods, may not be the only cause of wars. I will venture, however, as a reasonable hypothesis, well worth the most vigorous efforts to explode, that a substantial increase in production in all lands will guarantee peace more firmly and for longer than any other course that will be proposed." Thus another of our responsibilities is to hammer that fact home, not for our own self-satisfaction, but as a definite factor for world peace — more food for more people in peace as well as war.

ENGINEERING JOB IN AGRICULTURAL REHABILITATION

The training and experience of our membership has been presented before administrators of AMG organization, the Army's provost marshal general's office, the Navy's bureau of naval personnel, UNRRA, FEA, and USDA Office of Foreign Agricultural Relations, all being responsible for food production programs outside the United States.

Some leaders have requested the names of trained and responsible agricultural engineers in the armed forces to be transferred to the important job of agricultural relief and rehabilitation.

It is one of the ironies of this war that with each succeeding victory the demand for food increases, which means either less food for domestic and military requirements or an increase in production in the other lands. The need for food will not end with cessation of hostilities — not if we want a lasting peace in pioneering for tomorrow. Thus another of our responsibilities is to assume our role as engineers of food production.

American industry is winning the war. American production facilities converted to war production almost overnight have outproduced and are overwhelming the enemy. You and I will be surprised by the diversity of items and volume of materials produced—ships, planes, factories, cities, special vehicles and facilities for their functioning that stagger the imagination.

When hostilities cease, what will industry do? The reconversion period is approaching; in fact, in some industries it is here. To what will industry turn? Concurrent with the world's need for more food is the need for agricultural goods to produce that food. This is an opportunity for American war industry to reconvert into producing peacetime goods.

If we as agricultural engineers are ready with new products and new processes, industry can direct its efforts to agriculture and equipment for increased food production. Here is a brief picture of some of the possibilities in this direction.

While our farm power and machinery is recognized as highly developed today, there is still much to be done in mechanizing small farms, as well as farming operations not thus mechanized. For example, only 13 per cent of our corn is harvested with me-

chanical pickers. In addition, equipment must be available to handle the new crops being adapted to this country.

Electricity has come to agriculture with 40 per cent of the farms electrified. Early additions will probably double that number. These farms will demand more application of electricity — for power, temperature control, health and nutritional benefits. Picture such jobs as putting hay in the mow, unloading silage and sugar cane, initial processing of soybeans, automatic feed grinders and mixers, and we have a few opportunities for rural electrification research.

The condition of farm structures the country over is deplorable. Someone has said: "The slums of today are in the rural areas." I saw a chart from North Carolina showing that in only thirteen out of the 100 counties of that state has the value of farm buildings increased in the last 10 years. In 87 counties the value of farm building has decreased. No doubt other states have similar situations. Another problem is how can farm buildings be constructed so as to lend themselves to changing types of agriculture, etc.?

We are now realizing more and more the importance of maintaining and improving our producing soil through soil and water management. New soil practice data affects the field machines and possibly the crops themselves. Those are only a few problems.

COOPERATION OF ENGINEERS AND OTHER SPECIALISTS NEEDED

We look to state and federal research for assistance in solving these problems. This information is obtainable only through cooperation of agricultural engineering and other agricultural sciences. Without this cooperation the subject-matter groups become specialists and in turn isolationists. You are familiar with the reorganization of agricultural engineering in the U. S. Department of Agriculture. It seems promising and has untold possibilities, but the agricultural engineering program continues weak.

Permit me to comment on observation of research activities I made recently at the Beltsville Research Center where specialist isolationism seems apparent. Exhaustive studies are under way in nutrition of beef and dairy cattle, sheep, hogs, goats, poultry, and work animals. There are also breeding studies for milk, beef, skin, wool, fiber, hog bristle, and egg production in poultry, but I found little, if anything on housing requirements, humidity factors, temperatures, amounts of air, or use of the newly developed electric rays. Surely some of these factors should be taken into consideration in connection with animal studies. Is there not here a great opportunity for more cooperative projects?

Row after row of identical poultry houses, countless number of like hog houses, cattle barn after cattle barn, all identical from their physical characteristics, would indicate the agricultural research workers believe the engineering phase is static. The temperature changes of the United States from Canada to the Gulf alone should cause us to question the wisdom of this practice. Animal requirements obviously change with climate and other factors.

Exhaustive nutritional studies are carried on with low-quality grains and feed—materials devoid of or in varying low percentages of vitamins and mineral content. I hazard the statement that if the animal scientists, in cooperation with agricultural engineers, tell us the desired analysis of feeds that we as engineers will quickly find a way to process, cure, or handle the crops to meet these standards. Hay drying studies by Virginia Polytechnic Institute, Tennessee Valley Authority, Ohio State University and other stations are evidence of what we can do.

I observed work at Beltsville on crops, vegetables, and flowers wherein light and length of day are studied to obtain their effect on blossoming, size of plants, and productivity. Surely applying electricity—its various rays, amperages, voltages, and frequency—might prove most enlightening in connection with problems of ailing housed animals. The building and electrical industries would appreciate information on such things.

Exhaustive studies of long standing show the effects of various cover crops and cultivation in orchards. I failed to obtain any information on work in cultivation, that is, how deep for various soils, frequency of cultivation and proximity to surface and subsurface roots. These seem likely problems applicable to all climates and soils.

Refrigeration, dehydration, and other applications of temperature are other timely subjects. Numerous investigations show picking and temperature effects on fresh fruits and vegetables. Other work on frozen meats, both commercially and for home and locker freezing, indicates that more research is needed. If this research is cooperative with agricultural engineering, and has *as its objective* obtaining proper temperature controls and periods for proper freezing and storage, I feel that the desired units would be built. The same is true of any household appliance or utility. Investigations of present units is merely a check on the manufacturer in meeting present *arbitrary* standards and can hardly be classified as basic research. I have mentioned only a few observations, no doubt others could be discussed to advantage.

By the same token isolated agricultural engineering research will discover little if any basic production data. Our work must be cooperative with allied agricultural sciences. The valuable work on fertilizer placement, sugar beet equipment, and corn growing methods show what can be accomplished in cooperative programs. Perhaps much more is under way, but if so industry and the public are not aware of its source. Let's not permit specialization to continue making isolationists of us in research.

The test of research is its practical value to users. Will the objectives and results improve rural living and increase farm income? The findings of agricultural engineering research, unlike other sciences, invariably have to pass through the hand of a manufacturer to benefit the farmer. This is true whether the research calls for new practices, for new or improved machines, new materials, new types of structures, application of electricity, ventilating mechanisms, household equipment or what not. For that reason I contend that agricultural engineering research, whether by state or federal agencies, should be conducted in close cooperation with the various industries to the end that the results of research are made available to the farmer as quickly as possible.

Our industries, manufacturing more or less exclusively for agriculture, are desirous of research findings, results that offer opportunities for manufacture and at the same time provide desired goods for the farmer. These industries want the complete answer. Consequently, if state and federal research together do not give their share of the data, it may be necessary for manufacturers' associations or individual manufacturers to expand their own research centers with complete facilities. I, for one, hope that will never be necessary, for the federal and state experiment stations strategically located throughout the nation are ideally situated to obtain all the facts. Collectively, they have the climates, the humidities, the crops, the animals, and the soils to give the requirements of all states and areas. Thus another responsibility is to broaden agricultural research to include cooperation with all the sciences and all agencies.

INDUSTRY SEEKING MORE AGRICULTURAL ENGINEERS

It is most gratifying to note the increasing interest in our profession. Agricultural engineering is being enhanced by your contributions. Increasing those contributions will help materially in gaining the prominence we strive for and deserve. Industry is asking for more men with this training. It seems to me one of the expanding fields for agricultural engineering graduates should be industry—those industries manufacturing agricultural goods. I appreciate it was necessary in the beginning to train many agricultural engineers for state and federal agencies. Surely it is time the pendulum started to swing the other way and to train more engineers for industry.

Other nations are realizing the need for agricultural engineers. Representatives of other lands are emphatic in their need for the engineer in their agriculture. They state that more engineering in their agriculture will release men needed for their industries and commerce. They state it is the lack of engineering in agriculture that has kept them from attaining a higher status in their agriculture and improving their standard of living.

While visiting colleges and universities, I heard much about the postwar curriculums. Adequte planning now, and particularly in agricultural engineering, will aid in pioneering education for tomorrow. Arthur Sheridan said: "Engineering education today has done an excellent job, but within a scope too narrow for the role the engineer of tomorrow will be called upon to assume."

You of the colleges are faced with many serious problems. Physical plants, staff personnel, and student body are perplexing questions. Means of interesting undergraduates to complete their training, curriculum tempo, specialized courses, overemphasis in war training on vocational or technical instruction will confuse the public's thinking on the time requirements and value of professional education. Add these to our agricultural engineering problem of

five "standard" agricultural engineering curriculums and our problem is really complicated. Can't we eliminate one problem by standardizing on *one* curriculum from coast to coast so the term "agricultural engineering" has a definite meaning?

Then there is our responsibility as agricultural engineers in civic affairs. The American Society of Mechanical Engineers has the following statement in its code of ethics: "It is the duty of every engineer to interest himself in the public welfare and to be ready to apply his special knowledge, skill, and training in the public behalf for the use and benefit of mankind." Surely we can adopt that as a portion of our code of ethics. Such a code may call for college instruction acquainting the students with the organization and operation of the major elements of our democracy, its religious, social, economic, and political aspects.

An executive of a large manufacturing concern, and incidentally a professional engineer, stated before an engineering convention on curriculums: "Do not be indifferent to spiritual values in life, and *don't cold shoulder religion.*" Someone has said, "College young people are largely spiritual and religious illiterates, fatally ignorant in that all-important sphere of understanding which supplies that *binding element* in our complicated social order."

Madame Chiang Kai-Shek said in one of her impressive speeches: "We live in the Present, we dream of the Future, but we learn eternal truths from the Past." What have we learned from the past? Is it that as we are trained, so we act in after-college days? Did our many duties, responsibilities, and desires in college crowd out the spiritual and religious interests? If they did, then they will probably continue to do so in our after-college years.

OTHER ASPECTS OF THE ENGINEER'S RESPONSIBILITY

I wonder if we as engineers have worshipped the specialization complex and the bread and butter side of engineering to the extent that we have become isolationists and missed the great opportunity to help make secure the better world we are now all demanding. Have we ignored this "binding element" in our complicated social relationships in our desire "To get on with our profession?"

We have been part and parcel of our nation's rapid material growth. The war has accelerated the development of science — things, devices and processes. For the years of peace ahead, which we hope our influence will aid in making permanent, can we ever better afford to utilize some of this precious curriculum time for training engineeers for the direct responsibility of citizenship? They should be encouraged and we should set the example by exercising our responsibility in our respective spheres, church, municipal, state or whatever it may be. Citizenship responsibility is founded within the christian fundamental, "Love thy neighbor as thyself." I suggest we include the "binding element" of religion to cement the scientific - technological and the humanistic - social divisions of our curriculums as added assurance of lasting peace.

Those are some of the problems and opportunities facing us agricultural engineers in civilian life. We builded well during peacetime and we have withstood these war years. The blitzkrieg introduced in 1939 has increased in crescendo of destruction by all nations until it reached a holocaust on D Day and is continuing. Inversely our interest in civilian affairs has decreased.

I attended a high school graduation last week and listened to several fine talks by high school seniors. Many of those lads are already in training for the service of their country. They realize they are being tossed from youth into manhood overnight, yet all spoke with hope in their hearts and said: "Tomorrow, after the war, will be a great day of opportunity and achievement." War has not clouded their hopes.

It is up to us to take the advice of E. Stanley Jones and "plan intelligently so that we will not be prisoners of today but rather the pioneers of tomorrow." I know many of you are thinking of what is going on on the battlefields right now. Those boys and men are doing their part of a job that must be done *now*. Our responsibility to them is to plan, and motivate those plans, to be ready for them on their return, for in serving our fellow men we are in reality serving ourselves. We are not only insuring our own security, but fulfilling the moral purpose that makes a righteous cause invincible. So I ask you to envision with me beyond today and our specialized fields, as I give voice to those immortal words of Abraham Lincoln: "That this nation, under God, shall have a new birth of freedom and that government of the people, by the people and for the people shall not perish from the earth."

A New Irrigation Sprinkler

By M. A. Sharp
MEMBER A.S.A.E.

WHILE making soil erosion studies with the apparatus described on page 218 of AGRICULTURAL ENGINEERING for June, 1941, many farmers requested A. L. Kennedy, associate agricultural engineer, Tennessee Agricultural Experiment Station, to use that equipment for irrigation of truck crops. Several acres of various types of crops were accordingly irrigated to study the adaptability of the equipment for that purpose.

The pumping unit and the pipe were very satisfactory, but each sprinkler covered an area only 20 ft square, making it necessary to spend considerable time moving the sprinklers to new locations. Besides the time consumed in moving the sprinklers, it was necessary to make numerous trips in the muddy area just irrigated, which was very objectionable for all truck crops. A sprinkler which would cover a large area in a short time appeared to be essential.

Since there were no such sprinklers on the market, Mr. Kennedy developed a sprinkler with a capacity of 400 gpm, so designed that it would rotate slowly and distribute water uniformly over an area 150 ft square at 60 lb of pressure. With this method it is necessary to change the location of the sprinkler frequently, but only three trips in the irrigated area are needed to remove the sprinkler and pipe.

Field practice indicated that there would be a gain in time and convenience if two sprinklers each having a capacity of 200 gpm were used. By using this method it is not necessary to shut off the pump while changing locations. A valve in the delivery pipe is used to shut off the water from one sprinkler while it is being moved, the other absorbing the slightly higher pressure thus produced. It takes one man about 6 min to move a sprinkler to a new location, and for a one-inch application they are moved every hour. Data show that most soils will readily absorb 1 in of water in 30 min when dry enough to need irrigation, so one man could operate two sprinklers on a pumping unit delivering 800 gpm and cover nearly two acres per hour.

These sprinklers are attached to light-weight irrigation pipe couplings and can be connected to risers in a few seconds. Each sprinkler covers about one-half acre, dropping the water in a square pattern to avoid overlaps and dry spots. This reduces the cost of sprinklers, laterals, labor, and trips in muddy ground to a minimum. The high capacity enables a farmer to wait until his crops really need water, and then cover the area quickly.

The equipment is readily portable, easily and quickly set up, and low in cost. Custom service or community-owned units seems to be feasible in those areas where only a few acres per farm need irrigation. Fertilizer solutions may be added to the water at the pump very easily, assuring even distribution and rapid absorption into the soil. This sprinkler, developed in cooperation with the Tennessee Valley Authority, appears to have opened up new possibilities for irrigation, especially in those areas where only supplemental moisture is needed and ditches cannot be used.

This paper was prepared expressly for AGRICULTURAL ENGINEERING.
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This picture shows the Kennedy irrigation sprinkler in use. The small drops of water and even distribution may be noted

Brush Removal for Pasture Improvement

By Maurice B. Cox and Harry M. Elwell

THE encroachment of undesirable vegetation is often difficult to prevent, even under the best management, if maximum returns are to be obtained from permanent pastures. The presence of thistles or spiney plants that sheep will not eat often prevents satisfactory weed control under combination grazing with cattle and sheep. Goats have been used with favorable results under proper management for removing brush. If the stocking rate is sufficient to control the brush completely, there is a possibility of overutilization of the grass, which leaves the land exposed to erosion. When the brush extends above the reach of goats, it will be necessary to use some mechanical means of removal for complete control. Regardless of these methods of brush control, there is a definite need for machines for removing unpalatable plants and large brush.

There are millions of acres of shallow rolling land in central Oklahoma, Texas and Kansas that are covered with native grass and scrubby oak[3]*. Much of this land is being only partially used because the grass is too sparse for pasture and the timber is of little value except occasionally for posts or firewood. In 1935 an attempt was made at the Guthrie station to improve the use of such land by removing the tree and brushy growth. After the trees were removed, the grass soon spread and within three years developed a stand equal to that of virgin meadow[4]. Black jack and white oak sprouts have been controlled by spring mowing during the past eight years, but there remains a small percentage of the running oak. Through this type of management, much of the shallow scrubby oak land can be converted into useful pastures, and if grazed conservatively satisfactory returns can be obtained.

Due to the possibilities of better land use created by the clearing of pasture or grass land, there have been several kinds of machines designed for removing brush and controlling sprouts. Two implements have been used at the Guthrie station, the Jaques saw and power mowing machine. These machines were used on half-acre plots on which the trees and brush had been counted. The procedure for determining the size and number of plants was by a modified line transect[1]. This method consisted of belts 6 ft wide covering one-tenth of the plot, a procedure concurred in by the Oklahoma Agricultural Experiment Station forester. From these counts the woody vegetation was arbitrarily grouped into light, medium and heavy infestations. There were three repetitions of the different methods of clearing on the lightly infested land, but only one each for the lands with medium and heavy infestation. Results obtained are given in Table 1.

Mowing Machines. Both horse-drawn and tractor mowers have been used at the Guthrie station. These machines equipped with standard sections and guards operated satisfactorily on young tender sprouts and weeds. When heavy material was encountered, the long points and standard sections would bend or break if they struck big sprouts, stumps or stones. This difficulty was alleviated by equipping the mower with heavy sections and rock or round nose guards. Such equipment was used satisfactorily on oak, sumac and persimmon sprouts. In cutting the larger stems it was found advantageous to operate the tractor in low gear thus giving more cutting strokes per foot of travel. If trees too large for the mower were encountered, it was found advantageous to have the large material removed by hand ahead of the mower.

This paper was presented at a meeting of the Southwest Section of the American Society of Agricultural Engineers at Dallas, Texas, March, 1944.

MAURICE B. COX and HARRY M. ELWELL are, respectively, assistant agricultural engineer (cooperative agent) and associate soil conservationist, Red Plains Conservation Experiment Station (Guthrie, Okla.), Soil Conservation Service, U. S. Department of Agriculture.

*Superscript numbers indicate the references appended to this paper.

Mobile Saw. This equipment consisted of a 60-in saw mounted on the front of a McCormick-Deering F-30 tractor. It was found that this saw would cut trees 5 to 6 in in diameter at the ground level with the tractor in motion. To accomplish this, the tree was approached so that the saw would just barely cut through the trunk as it passed. The saw functioned very well on small trees with the tractor in motion. With the tractor not in motion, difficulties were encountered in cutting trees. This was particularly true where it was necessary to trim and remove fallen trees before further work could be done with the saw in the particular clump or area.

Another difficulty was the maintenance of the saw teeth under sustained work on large trees. When trees are cut at or near the ground surface, there is often much soil pulled into the saw cut. Where this condition exists, the grinding effect soon removes the set of the teeth which cannot be corrected by merely resetting.

Power-Lift Buck Rake. The problem of removing the brush was solved by the construction of an all-metal, power-lift buck rake[2] designed to operate on the front of a farm tractor equipped with hydraulic-lift cylinders. The rake was designed to operate the same as any other buck rake for loading, but the load can be lifted clear of the ground for transporting. It is capable of lifting a 1,000-lb load centered on the rake, high enough that the points of the teeth clear the ground 2 ft and the rear is raised to 14 in. The high lift permits the transporting of small trees and brush over rough ground and depressions. It was desirable to remove the brushy material for three reasons: (1) The heat generated by the burning would damage the grass that was to benefit by removing the brush, (2) the brushy material is valuable for gully control, and (3) it would be difficult to burn the wood stems where they fell.

The results show that land having about 25,000 shrubs under 2 in in diameter and not more than 50 trees of from 2 to 4 in in diameter per acre was cleared with approximately 7 hr of hand labor and 1.5 hr with a power mowing machine. After the brush had been cut, it required about one hour per acre to pile it with a power buck rake. The cost of such operations will vary depending upon the management and amount paid for labor. These results, however, indicate that such areas, which are lightly infested with brush, may be cleared at a cost of $5.00 to $6.00 per acre.

From the data obtained it appears that clearing operations on the heavily infested areas might exceed the value of the land. If the wood removed can be used for posts or firewood, the cost of clearing may be justified. If such land is cleared, it may be possible for trees to be removed in a systematic manner as firewood or posts are needed. In this manner a sizable area can be cleared at a minimum cost in a few years.

The results in Table 2 show that *(Continued on page 261)*

TABLE 2. GRASS DENSITY UNDER VARIOUS AMOUNTS OF SCRUBBY OAK SHADE AT GUTHRIE, OKLA., IN 1943

Per cent of land shaded	Grass densities†
None‡	15.5
20	12.0
60	6.3
90	3.0

†Determined by line transect[1].
‡Fully cleared land.

TABLE 1. RESULTS OF ACTUAL OPERATIONS FROM DIFFERENT METHODS OF CLEARING SCRUBBY OAK LAND, GUTHRIE, OKLA.

Estimated Density§	Brush and trees per acre according to diameter, in† 0 - 2	2 - 4	4 - 8	Over 8	Method of removing brush and trees	Hours of work per acre removing brush and trees: Man-hours labor	Machine: Saw	Mower	Buck rake	Wood ricks‡‡
Light	22,599	35	0	0	Mobile saw‡	2.96	1.48		1.0	0
Light	20,588	35	0	0	Mower & mobile saw††		1.13	1.06	1.0	0
Light	23,434	40	0	0	Mower & axe (man)	6.96		1.34	1.0	0
Medium	17,000	100	98	0	Mobile saw	34.00	8.5		1.0	7.8
Heavy	15,520	80	232	6	Mobile saw	63.50	11.0		1.0	31.0

§The results represent the average of three areas of the light densities, but only one of the medium and heavy. The counts were made by belt transects 6 ft wide covering one-tenth of each plot.

†Trees over 4 in in diameter were measured at breast height, but for smaller trees and brush it was taken one foot above the ground.

‡Saw was operated by "F-30" Farmall tractor.

††Mower was operated by "H" Farmall tractor.

‡‡Ricks of wood in pole.

The 1944 A.S.A.E. Gold Medalists

C. E. RAMSER

The American Society of Agricultural Engineers awarded the John Deere Medal to Chas. E. Ramser and the Cyrus Hall McCormick Medal to Leonard J. Fletcher on the occasion of its annual dinner, June 21, held during the 37th annual meeting of the Society at Milwaukee, Wisc.

L. J. FLETCHER

AWARD of the John Deere Gold Medal to Charles Ernest Ramser confesses the debt of agriculture, and of industry which serves it, to both pure and applied research by men in public service. It honors a man who probably has found out and made known for service to mankind the world's greatest fund of facts about the habits of flowing water as it affects the soil and the permanency of the world's food resources.

Born at Montezuma, Iowa, November 1, 1885, his secondary education was at the academy of Drake University and the high school of Newton, Illinois, near where he was reared on a livestock and hay farm. In 1909 he was graduated from the University of Illinois with the degree of bachelor of science in civil engineering and with memberships in Sigma Xi and Tau Beta Pi. For two years he taught in the Brooklyn (N.Y.) Polytechnic Institute, and in vacation worked in the designing department of the New York Board of Water Supply. In 1911 he was employed by the Aluminum Corporation of America on its water power development at Alcoa, Tenn.

In the opening days of 1913 he started as an assistant drainage engineer his career with the U. S. Department of Agriculture, advancing steadily in the realm of both drainage and soil conservation until 1929, at which time he was placed in charge of the technical phases of the agricultural engineering investigations on the first ten soil erosion experiment stations established by the Bureaus of Agricultural Engineering and Chemistry and Soils. In 1936 he was made chief of the Division of Hydrology in the Soil Conservation Service. Since 1942 he has been serving as research specialist in hydrology to the chief of research of the SCS, wherein he is responsible for the technical phases of its hydrologic investigations. In his recent duties he has been in charge of experimental work in the hydraulic laboratories at Spartanburg, S.C.; Minneapolic, Minn.; and Stillwater, Okla.; also of hydrologic studies at some forty locations throughout the nation.

Long before he had climbed so high on the ladder, however, he found and formulated facts which have guided the design of practically every successful drainage project in the 50 million acres of drainage improvements that have been installed since he started his investigations. Summarized in 1929 in USDA Technical Bulletins 129 and 184, these researches by Mr. Ramser still stand as the basis for drainage design.

Two facts are enough to show the significance of his studies. His investigation of runoff rates revealed that prevailing assumptions of capacity required were altogether too low. His procedure for determining accurately the effect of channel roughness on flow disclosed that the values of *n* as used in the Kutter formula likewise led to design of ditches too small even for the underestimated rates of flow. In connection with these studies he made the first experiments on flow in wooded floodways, and their results were used for the design of lateral floodways in the Mississippi flood control plans. *(Continued on page 261)*

SYMBOLIC of the inseparable intertwining of industry and education in the service of the agricultural engineering profession to farm and nation are the recurring cycles in the career of Leonard J. Fletcher. Born May 1, 1891, at Chadron, Nebraska, his heritage on the maternal side was Swedish, and from the paternal line Scotch-English. When he was nine the family moved to Iowa and Leonard shared the work and ways of a dairy farm until, in 1909, he was graduated from the Mason City High School.

Prophetically, perhaps, he then worked a couple of years in a retail hardware and implement house, incidentally acquiring the humble art of the tinsmith. Entering Iowa State College in the fall of 1911, he earned his way mainly by missionary merchandising of aluminum ware. After graduation in 1915 as a bachelor of science in agricultural engineering he remained a few months working on creation of a self-supporting clay block arch for fireproof barns.

After a year as instructor in agricultural engineering at Washington State College, he started in 1916 a decade of service in the college of agriculture at the University of California. In 1920 he became head of the department, in charge of teaching, extension and research in agricultural engineering. While on the California faculty he served as the first chairman of the state Committee on the Relation of Electricity to Agriculture.

With the New Year of 1927 he entered his connection with the Caterpillar Tractor Company, where his duties have been too diverse to detail briefly. As director of agricultural sales he developed a technically trained staff and conducted research in the efficient use of Caterpillar power in farming, and in farm management for economic power methods. Most of 1929 and part of 1933 he was in Russia, demonstrating the use of tractors and combines, establishing training schools, designing repair shops, etc.

As assistant general sales manager his varied duties included special emphasis on the technical application of the company's products, not only methods and organization of utilization in the field, but advances in the design and construction of the machines themselves to match more perfectly their opportunities for performance. In 1941 he became director of training.

With the impact and pressures of war, this work suddenly became worthy of the ingenuity and energy which Mr. Fletcher was able to apply. All his experience as workman, engineer and educator was focussed on the pressing problem of mobilizing man power and teaching it swiftly and surely to do well new and exacting operations. His methods not only had much to do with Caterpillar's contribution to war production, but served widely as a pattern for industry at large and were adapted by him to training of new personnel in farming.

Because he always has been bigger than his job, always able and willing to do more than its measure, his accumulated contributions to the engineering of agriculture are largely extra-curricular. From his admission in 1918 he has been consistently active in the American Society of Agricultural Engi- *(Continued on page 259)*

A Method of Approach to Farm Power Studies

By H. H. Stippler

CONSIDERABLE progress has been made in the determination of the amount of labor used by farmers to perform various field operations necessary to produce certain crops. Variations in the use of labor betweeen areas, crops, and types of farm organization have been studied and farms have been classified by the amount of labor used to operate them. No strict distinction is made between labor requirements and labor use. Rather, average or most economical labor use per acre or per farm is assumed to be the labor requirements.

Such studies generally are based upon a given or assumed level of mechanization of agricultural production existing in an area. Power use is usually expressed by the number of tractor-hours of an "average" tractor or, in the case of horses, by the number of horse-hours. In most studies of this kind little attempt is made to ascertain the reduction in the use of labor resulting from progressive mechanization or the increase in the use of power necessary to lower labor needs. The use of labor and power, however, are so closely connected that it is doubtful whether an adequate study of labor requirements of crops or farms can be made without considering at the same time the corresponding power requirements.

A comparison of labor used for one crop such as sugar beets with another such as beans grown in the same area might show a considerable difference at a given level of mechanization. The amount of power used for these crops may be approximately the same at one particular time, but with a further mechanization of sugar beet production may change drastically and result in a lowering of the amount of labor approaching that of beans. Similarly, a comparison of sugar beet production requirements in two different areas would be incomplete if only labor requirements were compared because a difference in the amount of power may account for a difference in labor and no advantage of one area over the other would exist if the same level of mechanization was attained in both areas.

Probably the main reason why the use of power in addition to that of labor has not received more attention is the fact that different types and sizes of both animal and mechanical power units make a determination of power used somewhat difficult. While the amount of work accomplished by the use of power has a close relationship to the amount of power required, the variation in type and size of power units is much greater than is the case with hand labor. For labor employed in operating a machine it is customary to speak of a man-hour of work whether the work is or can be performed by a boy or a middle-aged man operating either a small or a large power unit.

Farm power used for field work may consist of different size units of animal or mechanical power or both. Many farmers employ tractor power for operations requiring comparatively large amounts of power or in cases where speed is of great importance. For light work or in cases where time is not a limiting factor, animal power is frequently being employed. On farms where both types of power are available, heavy work of land preparation and harvesting is most commonly done with tractor power. Seeding and crop cultivations are frequently performed by animal power.

In a study of the use of power on family-sized irrigated farms in Idaho[1], it was found that of the 277 tractor farms for which complete records were obtained 28 farms had no horses. The remaining 249 farms had horses, the number of which increased with the size of farm. Of the 28 farms that did not have horses, only 8 did not employ any animal power. On 20 of these farms, some work done by horses was either hired or exchanged for tractor work. It is apparent from these records that many farmers kept a few horses for sentimental reasons and used them only occasionally, or that they had not as yet completed the transition from animal to mechanical power. The majority of farmers, however, kept horses for definite purposes and replaced them when they became too old for effective work. This seems to indicate that for these farmers it is not a question whether it is more advantageous to employ animal or mechanical power, but rather in what combination of employment of these two types lies the greatest advantage. There is no need for enumerating here the advantages and disadvantages of animal and tractor power under farm conditions. They vary from farm to farm and area to area. The fact remains, however, that many farmers seem to feel that both types should be employed side by side rather than one to the exclusion of the other. This holds true even though small tractors more nearly approach a team of horses in power and adaptability for light work.

A major problem in making studies of farm power is involved in the determination of efficiency in the use of power, not only if the same type of power is being employed but particularly if varying sizes and types of mechanical and animal power units are used for the production of a given crop or on a given farm. To measure efficiency, power requirements are compared with power consumption and it is of utmost importance that a clear distinction be made between power or *energy required* and *energy used or expended*[2].

Power requirements are obtained from actual field tests and remain the same regardless whether mechanical or animal power is actually employed to do the work. They serve as a measuring stick in determining efficiency in the operation of various types of power on farms. It would be incorrect to assume that the amount of power used as calculated from information obtained from farmers without making actual field tests is the amount of power required

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

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AUTHOR'S ACKNOWLEDGMENT: Grateful acknowledgment is made of the valuable assistance received from Professor B. D. Moses, division of agricultural engineering, University of California, in consultation and review of this paper.

[1]Cooperative study of the USDA Bureau of Agricultural Economics and the Idaho Agricultural Experiment Station. All farm data used in this discussion to illustrate the method suggested have been collected in the course of this study. They are preliminary and for discussion purposes only.

[2]Strictly speaking, "power" by definition designates the capacity or size of unit and is expressed in horsepower-hours. In this discussion the term "power" is frequently used in the sense of the word "energy".

even though the sample is representative and does not show extreme variations. On the other hand, it would be an impossible task to determine power requirements for individual field operations on every farm separately. Power requirements, therefore, must necessarily be averages for a given area of fairly uniform soil and climatic conditions. They must take into account conditions under which farmers operate; that is, they must be possible of attainment on farms if they are to be used as realistic standards in judging the efficiency in the use of power. Power requirements in addition to giving the power needed to perform a certain amount of work should include a reasonable amount of power needed for moving to and from the field as well as other overhead.

Major attention is given in the following discussion to the determination of power consumption in field operations. For the calculation of power requirements which are important in setting standards some changes in the established practice are suggested to account for a difference between requirements under strictly test conditions and those obtained under normal farm conditions.

Determination of Standards of Power Requirements. Dynamometer tests which have been made for various operations in many areas could serve as a basis for determining power requirements for use in arriving at standards. Seldom, however, do such test data approach actual field conditions and great variations are found in the amount of power required. Thus, power requirements per inch or foot of implement can be average values only and must be obtained under conditions approaching as closely as possible those under which farmers operate if they are to serve as realistic standards attainable in practice.

In a determination of power requirements for field operations performed on farms that are to be used as standards for a particular area, the following method is suggested:

1 Calculate the total energy requirements for a specific time period from the drawbar pull of an implement (ascertained from tests if possible) and the average speed at which the particular operation is usually performed.

2 Obtain the average time required on an acreage basis.

3 Determine the theoretical acreage covered using width of implement, speed of operation, and time of application.

4 Reduce the calculated acreage by the application of a factor which takes into consideration that, under field conditions, delays and overlapping of implements drawn are unavoidable. Records for plowing in the Idaho study indicate that the acreage covered per day as reported by farmers was 84 per cent of the acreage calculated, and for harrowing 76 per cent. More frequent stops to clear the implement of trash as well as more overlapping account for a proportionately smaller actual performance in harrowing. Therefore, in order to bring the theoretical standard of energy requirement as closely as possible in line with actual performance, the calculated acreage should be reduced by this factor for each operation separately.

5 Determine *drawbar horsepower-hours required per acre* by dividing total energy requirements as determined from (1) for the various operations by the acreage covered from (4). These will serve as standards for a particular area with which power used on farms may be compared.

Determination of Mechanical Power Used in Field Operations. More difficult than the calculation of standards of power requirements is the determination of the amount of power and energy actually used by farmers. Different types and sizes of animal and tractor units, different kinds of fuel, and different conditions of traction all result in different amounts of energy actually expended. Fortunately, data available from the Nebraska tractor tests offer a method for determining mechanical power used in field operations if an accurate description of the type of tractor and information with regard to fuel consumption and acreage covered per day is secured from farmers.

Before these test data can be used certain adjustments in them appear to be necessary to account for differences in test and field conditions. A tractor on a farm is not being operated under the same conditions of load as during a relatively short test when the load is accurately controlled. Furthermore, farmers frequently use a certain make of tractor with a different type of fuel or with a different type of traction than that which was used in the Nebraska tests.

The adjustments that appear necessary may best be illustrated by the examples shown in Table 1. Tractor A has a rating of 20 hp on the drawbar and 26 hp on the belt. The type of traction during the test was rubber tires and the fuel used was distillate. The belt tests indicate that this tractor developed 11.0 hp-hr per gal of fuel at rated load and 9.11 hp-hr per gal at varying load[3]. Power developed per gallon of fuel at varying load therefore is almost 83 per cent of the power developed at rated load[4].

Drawbar tests have been made at rated load only, and since hardly any tractor is operated on farms continuously at this load it is thought necessary to reduce the power developed per gallon of fuel by the difference between the horsepower-hours per gallon at rated and varying loads in belt tests. Tractor A developed 9.57 hp-hr per gal of fuel at rated load on the drawbar which in this case would be equivalent to 7.92 hp-hr per gal at varying load[5].

Further adjustments of Nebraska test data are frequently needed where tractors are used on farms with different wheel equipment and fuel than those used in tests. These adjustments are also shown in Table 1. Tractor A may be used with steel wheels instead of rubber tires. Other tractors may use gasoline as fuel instead of distillate with which they were tested. Test data even if adjusted for less power developed under farm conditions as shown above would not be directly applicable. In the case of an adjustment from rubber tires to steel wheels for a tractor using distillate (Tractor A, Table 1), the amount of adjustment can be approximated by the average differential for power and fuel consumption on the drawbar of all tractors using distillate and tested on both rubber and steel wheels. The Nebraska tests show six cases of tractors using distillate that were tested on both types of traction. The average drawbar horsepower-hours per gallon of fuel developed on steel wheels was 76.5 per cent of that on rubber tires. Fuel consumption per hour was 9.2 per cent greater on steel wheels than on rubber. Conversely, power developed on the drawbar by steel-wheeled tractors using distillate is increased 30.7 per cent and fuel consumption is decreased 8.4 per cent if used on farms with rubber tires. Tractor B in Table 1 is an example of adjustments made for a conversion from steel wheels to rubber tires of a tractor using

[3]Varying load belt tests (Test E) are explained fully in Nebraska Experiment Station Bulletin 338, page 6. Test data for individual tractors are published, among other places, in the annual editions of the Red Tractor Book published by "Implement and Tractor."

[4]This factor of 0.83 takes into consideration differences in efficiency of the engine at different conditions of loading, acceleration, etc.

[5]This adjustment accounts for differences in engine performance only and does not adjust for variation in efficiency of transmission and traction. The latter are assumed to be negligible for all practical purposes.

TABLE 1. ADJUSTMENTS IN NEBRASKA TEST DATA

						BELT TESTS						DRAWBAR TESTS			
						Horsepower-hours per gallon			Gallons per hour			Test H		Test H Adjust.	
Make and model of tractor	Nebr. test no.	Type of traction	Type of traction	Fuel used	Rating, hp* db - bt	Var. load, test E	Rated load, test D	Test E in % of test D	Var. load, test E	Rated load, test D	Test E in % of test D	Hp-hr per gal	Gal per hour	Hp-hr per gal	Gallons per hour
Tractor A	X	Tricycle	Tires	Distillate	20 - 26	9.11	11.00	82.8	1.791	2.397	74.7	9.57	2.140	7.92	1.599
	X_1	"	Spade	"	20 - 26	"	"	"	"	"	"	7.32	2.337	6.06	1.746
Tractor B	X	Four-Wheel	Spade	Gasoline	16 - 25	8.21	10.54	77.9	1.807	2.385	75.8	6.92	2.299	5.39	1.743
	X_1		Tires	"	16 - 25	"	"	"	"	"	"	8.71	2.193	6.79	1.662
Tractor C	X	Tricycle	Spade	Distillate	12 - 21	7.90	10.17	77.7	1.625	2.056	79.0	6.50	1.870	5.05	1.477
	X_1	"	Spade	Gasoline	14 - 23	7.92	10.18	77.8	1.822	2.326	78.0	6.58	2.074	5.12	1.618
Tractor D	X	Tracklayer	Cleats	Gasoline	18 - 24	6.67	7.89	84.5	2.283	3.072	74.3	6.35	2.949	5.37	2.191
	X_1	"	"	Distillate	16 - 22	6.65	7.88	84.4	2.036	2.703	75.3	6.27	2.657	5.29	2.001

* Figures rounded to the nearest full horsepower.

gasoline. It is true, of course, that tractors when tested on rubber tires are operated at higher speed than when tested on steel wheels. However, this is also true on farms where tractors on rubber tires are generally operated at a higher speed. Slippage differences are automatically taken care of by differences in traveling speeds.

In case a tractor is operated with a different type of fuel than that used in the Nebraska tests the same procedure of adjustment of power and fuel consumption is followed although the adjustment will be found to be of minor importance. Examples of this type of adjustments are shown for Tractors C and D in Table 1. It should be pointed out here that in determining the amount of adjustment for different types of traction and different fuels used the wheel equipment or the fuel are the only variables. In other words, different adjustment factors are obtained for tractors using distillate if changed from steel wheels to rubber tires than if the same adjustment is necessary for tractors using gasoline.

TABLE 2. CALCULATION OF TRACTOR POWER USED IN FIELD OPERATIONS

Make and rating of tractor; type of traction, steel wheels; fuel used, distillate; Nebraska test No. X; adjusted drawbar horsepower-hours per gallon, 5.39; fuel consumption (gph), 1.258 - 1.589; speed of gears (mph), I-2.52, II-3.34, III-4.33

	Survey Data							Check Data				Derivation and Computation			
Field Operation	Size of Implement	Gear used	Total hours per day	Hours of actual field work	Acres covered per day	Fuel used per day, gal	Acres covered during whole season	Cal-cul-ated acres per day	Calculated time of field work Var. load, hr	Calculated time of field work Rated load, hr	Total hours of actual field work for season	Total fuel consump-tion for season, gal	Total adjusted dhp-hr for season	Adjusted dhp-hr per acre	Man-hours per acre
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)
Plowing sod	1, 14-in	I	10.5	10.0	4.0	16.0	13.0	3.6	12.7	10.1	33	52.0	280.3	21.6	2.7
Plowing stubble	1, 14-in	II	10.5	10.0	5.0	15.0	7.5	4.7	11.9	9.4	15	22.5	121.3	16.2	2.1
Plowing row-crop land	1, 14-in	III	10.5	10.0	6.0	16.0	5.0	6.1	12.7	10.1	9	13.5	72.8	14.6	1.8
Levelling	9 ft.	I	10.5	10.0	15.0	16.0	31.5	27.5	12.7	10.1	21	33.6	181.1	5.7	.7
Levelling	9 ft.	II	10.5	10.0	22.0	15.0	87.0	36.4	11.9	9.4	40	59.4	320.2	3.7	.5
Disking plowed land	6 ft. tandem	II	10.5	10.0	18.0	14.0	63.0	24.3	11.1	8.8	35	49.0	264.1	4.2	.6
Harrowing, springtooth	2-sec	I	9.0	8.0	16.0	13.0	14.0	19.5	10.3	8.2	7	11.5	62.0	4.4	.6
Harrowing, spiketooth	2-sec	III	10.5	10.0	40.0	13.0	16.0	42.0	10.3	8.2	4	5.2	28.0	1.8	.3
Planting beets	4-row	I	6.0	5.0	10.0	7.0	10.0	11.1	5.6	4.4	5	7.0	37.7	3.8	1.2
Planting potatoes	2-row	I	8.0	6.0	6.0	9.0	6.0	11.0	7.2	5.7	6	9.0	48.5	8.1	2.7
Seeding grain	6-ft drill	III	4.0	3.0	7.0	4.0	7.0	9.4	3.2	2.5	3	4.0	21.6	3.1	.6
Cultivating beets	4-row	I	8.0	7.5	10.0	10.0	7.0	16.7	7.9	6.3	53	70.0	377.3	5.4	.8
Cultivating potatoes	2-row	II	8.0	7.5	12.0	10.0	24.0	19.1	7.9	6.3	15	20.0	107.8	4.5	.7
Binding grain	5 ft.	II	6.0	5.0	8.0	7.5	7.0	10.1	6.0	4.7	5	6.6	35.6	5.1	1.6
											251	363.3	1958.3		

Method of Computation:
Col. 9 = Col. 2 (expressed in feet) x Col. 3 x Col. 5 x 5,280 ÷ 43,560
Col. 10 = Col. 7 ÷ 1.258
Col. 11 = Col. 7 ÷ 1.589
Col. 12 = Col. 8 ÷ Col. 6 × Col. 5
Col. 13 = Col. 8 ÷ Col. 6 × Col. 7
Col. 14 = Col. 13 × 5.39
Col. 15 = Col. 14 ÷ Col. 8
Col. 16 = Col. 4 ÷ Col. 6 × number of men required.

Nebraska test data together with all necessary adjustments as described above should be listed for tractors found on farms for which complete records of field operations are obtained. The data include those shown in Table 1 as well as the speeds of the different gears as given in Nebraska test records.

Every farm record should be provided with a separate work sheet for all tractor operations performed on the particular farm similar to that illustrated in Table 2.

The data shown in Table 2 are examples of the calculations for some of the more common field operations found on a small-sized irrigated farm. Below the heading of the table general information as to the available power unit on the particular farm and the applicable Nebraska test data developed and adjusted as shown in Table 1 is recorded. Adjusted drawbar horsepower-hours per gallon, amounting to 5.39, represents the power developed under varying load at the drawbar. Under fuel consumption a range is given of which the lower figure represents fuel consumption for a varying load at the drawbar, the higher represents fuel consumption at rated load. These data for fuel consumption are used for checking purposes only and do not enter the calculations of power used.

In columns 1 to 8 inclusive (Table 2), information is listed which is obtained from farmers. Columns 9 to 11 are check columns on the information obtained, and columns 12 to 16 are calculations of the amount of power and labor used. In plowing sod, for example, the farmer reported using a one-bottom 14-in mold-board plow. He operated in the first gear for a work day of 10½ hr of which 10 hr were actual field work. Actual field work excludes time for servicing and moving to and from the field.

PRECISE DATA NOT TO BE EXPECTED

He reported plowing four acres per day using 16 gal of fuel. The total acreage of plowing sod during the season was 13 acres. In obtaining information of this kind it must be recognized that farmers cannot be expected to be very precise in giving the hours the tractor was actually pulling the equipment, nor the precise acreage covered and the amount of fuel consumed. Frequently farmers are inclined to overstate the time they actually operate the equipment per day, or, in other words, underestimate the time that is normally consumed for servicing, other stops, and moving to and from the field. The acreage covered per day is usually rounded to the nearest acre which for some operations such as plowing is significant. Fuel consumption is also rounded to the nearest gallon. This in itself, however, is not as significant as the fact that farmers cannot separate the fuel consumed for moving to and from the field as well as for the time during which the tractor was idling. Therefore, only average values can be obtained. For a large number of cases, however, these averages are significant.

In column 9, Table 2, the calculated acreage is given using the width of the implement, the speed of operation, and the time of application as reported by the farmer. The calculated acreage of sod plowed in a day is 0.4 acre lower than that reported by the farmer which may be due to rounding the acreage plowed per day to a greater speed than that under which the tractor was tested, or to a longer time of operation than that reported. Ordinarily the reported acreage is lower than the calculated acreage for all operations except in a few cases of plowing sod or stubble. When the calculated acreage exceeds the reported acreage by a considerable amount, a check of the number of hours the equipment was operated is necessary. This check is shown in columns 10 and 11. Figures in column 10 have been obtained by dividing fuel consumption per day as reported by the farmer by the fuel consumption for the particular tractor under varying load conditions. For column 11 fuel consumption at rated load has been used. For most operations the actual hours of field work as reported fall within the limits of the time calculated from fuel consumption. They may, however, be slightly above or below depending upon the age and condition of the tractor as well as other factors. For heavy work such as plowing and leveling, fuel consumption per hour approaches or slightly exceeds that at rated load while for lighter operations the reported fuel consumed approaches that calculated for a varying load on the drawbar. In the case of plowing sod the reported fuel consumption of 16 gal per day indicates that the tractor was operated between 10.1 and 12.7 hr per day while

the time of actual field work reported was 10 hr. Considering acreage covered per day and fuel consumption, it appears that the farmer possibly operated more than ten hours in which case the calculated acreage would more nearly equal the reported acreage.

The use of power for plowing one acre of sod could be calculated from columns 6 and 7 and the drawbar horsepower-hours per gallon as given at the head of the table. However, columns 12 to 14 have been included to obtain the total hours of tractor work, total fuel consumption and total power used for one particular kind of field operation during the season and to facilitate the summarization of hours of field work, fuel consumption and power used for the whole season. The power actually used during the whole season for all operations performed by the power unit should then be compared with the power available on the basis of a normal season as well as with power requirements of this particular farm as arrived at by employing the use of standards discussed earlier.

The analysis of power used for various operations should go farther than is indicated above where the efficiency in the use of power on a given size and type of farm organization is the main objective. A large number of records of the use of different types and sizes of power units as well as implements doing one particular type of work, such as plowing, permits a study of the efficiency in the use of power and supplementary equipment and of the factors that influence the amount of power used. Records for plowing in one area indicate that farmers who used a 10-hp tractor pulling a one-bottom 16-in plow had a power consumption equivalent to slightly less than 20 dhp-hr per acre. Those using an 18-hp tractor with the same size of implement showed a power consumption equivalent to 27 dhp-hr per acre. Farmers frequently cannot load the tractor to capacity in all operations because in addition to the desirability of an adequate load for the tractor there are considerations of the annual use of the implement and the investment involved. The latter are often of equal if not greater importance to farmers than the efficiency or cost of operating the power unit. Furthermore, on many of the smaller farms tractor power is being used to operate implements formerly used with horses. In most cases this results in an inefficient use of power although farmers may feel that they cannot afford the additional cash expenditure for new and generally larger implements to be used with a tractor. The suggested analysis of the individual field operations would provide much needed basic information as to the proper relationship between size and type of farm organization and size and type of power units and implements.

Determination of Animal Power Used in Field Operations. It was previously pointed out in this paper that on many farms where tractors are in use animal power is also being employed generally for work that is either comparatively light or does not have to be performed within relatively short time limits. With regard to power requirements to perform such work it is immaterial whether animal or mechanical power is used, requirements are the same. The actual use of power, however, may vary considerably.

Studies of horsepower used to perform certain field operations have been made in many areas. The amount of horse work is commonly expressed by the number of horse-hours per acre. As long as no mechanical power is employed on the same farm this is a procedure that is generally satisfactory. Difficulties arise, however, if both mechanical and animal power are being used on the same field or farm. Horse-hours cannot be combined directly with horsepower-hours nor is it possible to use one single factor in converting one into the other without regard to the type of work done.

By budgeting all field operations on an 145-acre irrigated farm of a specific organization, it has been found that according to average rates of power used by farmers in the particular area a total of 5,935 dhp-hr would be used for all necessary operations if tractor power were employed. Performing the identical work with horses on this farm 3,910 horse-hours would be used. In other words, on the basis of these figures a power consumption of 1 dhp-hr equals six-tenths of that of one horse-hour. This ratio could be used for conversion if in one case all work were done by the tractor and in another case all work were performed by horses. The ratio, however, is not constant for all sizes and types of farms. Great variation exists also between crops and individual field operations which accounts for the fact that the tractor is employed where it is at an advantage while horses do work where they are more economical. Performing all necessary operations with a tractor on an acre of potatoes results in the use of about 90 dhp-hr; doing the same work with horses results in a use of 62 horse-hours. In this case the amount of work of 1 dhp-hr equals almost seven-tenths of that of a horse-hour. For sugar beets 1 dhp-hr equals slightly over five-tenths of a horse-hour. The variation in this ratio is still greater for individual field operations such as plowing, harrowing, cultivating, etc.

In this connection mention should also be made of the variation in the amount of man labor employed in operating the different types of power sources as a factor in determining which power source is most likely to be used. In the above-mentioned example of performing all field operations on a farm of 145 acres, 636 man-hours are used to do the work with the common size of tractor and equipment, 1,343 man-hours are needed to do the same work with horses, a ratio of 1:2.1. The ratio is 1:2.2 per acre of potatoes and 1:1.8 per acre of sugar beets. This emphasizes again the close connection between power and labor and the necessity of including power use in studies of farm-labor needs as well as labor needs in studies of farm power.

The fact that on many farms horses are employed in addition to tractor power and that the use of either power source is determined by the farmer on the basis of advantages and disadvantages at the particular time when the choice has to be made, makes it necessary to find a common denominator for horse power and tractor power or to express one in terms of the other. Since standards of power requirements for a particular area are expressed in drawbar horsepower-hours per inch or foot of implement it seems desirable to express animal power used in terms of equivalent drawbar horsepower.

The conversion of horse-hours into equivalent drawbar horsepower-hours cannot be made for each individual farm as comparable data for individual field operations on each farm are usually not available. A conversion factor obtained from a large number of records for one field operation, therefore, must be applied to individual farms where horses were used to perform the particular operation. Several bases can be used in determining a factor to convert horse-hours into equivalent horsepower-hours for a specific field operation in a given area. First, a conversion factor may be obtained by using the most efficient combination of power and equipment for horses and tractor power. This does not appear to be very realistic as only few farmers in a given area would use such a combination and the purpose of the study is to measure inefficiencies due to combination of power and equipment as well as other factors. Second, the most frequent combination of size of power and equipment could be used. This probably would eliminate some of the objections to the first method but would not take into account the fact that a certain proportion of inefficient combinations do exist in an area and should influence the conversion of horse-hours into horsepower-hours. The third method, therefore, is recommended here in which the average of all cases of doing the work with horses and tractor power is used to ascertain conversion factors.

In Table 3 a few samples of conversions of power and of labor for operating the power are given for some of the field operations. Except for plowing, all operations shown are those in which horses are used most frequently in this area. Other factors being equal, the advantage of horses over mechanical power is greatest in field

TABLE 3. CONVERSION OF ANIMAL POWER INTO MECHANICAL POWER FOR TYPICAL FIELD OPERATIONS IN A SPECIFIC AREA

	POWER			LABOR		
Field Operation	Ave. horse-hours per acre	Ave. dhp-hr per acre	Conv. factor for power	Ave. no. man-hours per acre using horses	Ave. no. man-hours per acre using tractor	Conversion factor for man labor
Plowing sod	18.0	22.0	1.22	4.5	2.1	.47
Leveling	2.7	4.7	1.74	0.7	0.4	.57
Harrowing, spike tooth	1.9	3.6	1.89	0.5	0.3	.60
Drilling grain	2.7	4.9	1.81	0.9	0.6	.67
Binding grain	3.5	6.6	1.89	2.1	1.2	.57
Mowing alfalfa	2.2	4.9	2.23	1.1	0.5	.45
Planting potatoes	3.9	8.0	2.05	2.1	1.3	.62
Cultivating potatoes	3.2	5.6	1.75	1.8	0.6	.33
Digging potatoes	10.9	17.2	1.58	3.1	2.3	.74
Cultivating beets	1.9	4.6	2.42	1.0	0.5	.50
Lifting beets	7.0	15.2	2.17	3.8	1.8	.47

operations in which the conversion factor is greatest. In plowing, as well as other field operations requiring relatively large amounts of power at a steady pace, the tractor is at an advantage.

It must be recognized that in this particular area the combination of power and equipment has considerable influence upon the conversion factor obtained. In cultivating beets two horses are used to pull a four-row cultivator. The average rating of the tractor pulling the same size implement was 13 dhp. Since this operation cannot be performed much faster than is done by horses and the width of the implement cannot be increased appreciably, the tractor cannot overcome the advantage of the horses. In most cases two horses are used to pull a one-row beet lifter. The average rating of tractors pulling the same implement was 15 hp. On the other hand, the average rating of a few tractors pulling a two-row beet lifter was 11 hp. Farmers that used a two-row beet lifter had a power use of 8.1 dhp-hr per acre. If all farmers had this more efficient combination of power and equipment, the conversion factor for lifting beets in this area would be 1.15. Similar conditions exist for other field operations reflecting inefficient use of power. The use of these conversion factors in a given area for individual field operations for which horses were used permits the determination of total power used to operate farms of given size and organization and a comparison of total power used with the standards of power requirements.

CONCLUSIONS

The above discussion of a method suggested for farm power studies is limited to a determination of power requirements and use for field operations only. This comprises by far the major portion of the demand for power on farms and generally determines the size of power units to be employed. Relatively small amounts of power are needed for such a job as hauling of supplies and farm products as well as some belt work such as cutting silage or grinding feed. On most farms this type of work can readily be done with the reserve power available during the off season. Often auxiliary power sources such as trucks for hauling and electric motors for belt work are employed instead of tractors or horses. If these jobs, however, are relatively minor in importance and infrequent, farmers may hire the work done.

Under the assumption that other than field operations will have little effect upon the size and type of the major kind of farm power employed, a study could be limited to power required and used for field operations only. On the other hand, there are a number of reasons why farm power studies should include total power requirements and uses by different sizes and types of farm organizations regardless whether the work is done by available power sources on the farm or whether it is hired. To insure comparability power needs and consumption should be expressed in horsepower-hours. Furthermore, a segregation of power used for field operations and that for miscellaneous other jobs should be made.

In the foregoing discussions the usefulness of the data and the application of results which is made possible by the proposed method of analysis of farm power studies has been touched upon briefly. The major advantage of the method discussed and the use that can be made of the results may be summarized as follows:

1 The method of analysis suggested will bring about a clear distinction between "power" requirements and "power" consumption. Conditions that are or are not under the control of farm operators result in a greater energy consumption on farms than is required. For this reason a clear distinction must be made between energy required and energy used.

2 The determination of standards of energy requirements per unit of implement under conditions approaching as closely as possible those under which farmers operate, provides a measuring stick which is needed to ascertain the degree and the reasons for inefficiency in the operation of power employed on farms. Inefficiency in operation and the reasons for it, in the case of mechanical power, can be determined in this way more accurately than is possible at present in the case of man labor or animal power studies.

3 The determination of energy consumption necessitates some adjustments in Nebraska test data and the securing of information from farmers. While data for a limited number of cases may not be significant a large number of records will provide useful averages which when compared with energy requirements permit an analysis of the reasons for inefficiency in the operation of power.

4 Expressing energy requirements and energy consumption in drawbar horsepower-hours per acre makes it possible to combine records of various types and sizes of power units. It also permits the calculation of costs per drawbar horsepower-hour used which is a more clearly defined power unit than a tractor hour of an "average" tractor.

5 The conversion of horse-hours used into equivalent drawbar horsepower-hours used in a particular area where both types of power are employed permits the determination of energy consumption per acre of various crops as well as energy consumption for farms of different sizes and types or organization.

6 Farms of a given type can be classified by the amount of energy required or used in addition to present classifications by size expressed in acreage or hours of man labor used.

7 Changes in the method of producing or operating farms over a period of years can be adequately measured as far as the use of power is concerned.

8 The relationship between the use of power and labor can be studied more adequately and the decrease in the use of labor accompanying an increase in the use of power can be measured.

9 The analysis of energy used for individual field operations will provide the basic information needed to determine the proper relationship between size and type of farm organization and size and type of power units and implements.

10 Data of fuel consumption combined with engine efficiency and the energy requirements per acre permit comparisons of energy used for various crops in a given area as well as for the same crop in different areas. The influence of soil and climatic conditions upon the amount of energy used can be approximated more closely than heretofore and the advantages and disadvantages of the various producing areas in the use of power can be pointed out.

Increasing mechanization of agricultural production which is expected to make considerable headway during the postwar years, emphasizes the need for studies of the use of farm power and suggests the necessity of more accurate measures for "power" requirements and "power" consumption in agriculture. These measures will be of great value in determining the types and sizes of power units and implements that are most economical and will point the way to greater efficiency in the use of power on farms.

Flue Curing of Chopped Hay

TO THE EDITOR:

IN response to a suggestion in AGRICULTURAL ENGINEERING some months ago and a letter in the April issue by Frank H. Hamlin regarding curing chopped hay, we are glad to report that research work in this field is being done here. A gasoline-driven fan unit which will deliver preheated air is on hand and experimental data will be available this fall. Plans have been completed for another phase of hay drying which will involve a flue type storage bin in which full length as well as chopped hay will be dried. We hope to have data available for release on the flue curing of hay some time this fall.

M. A. SHARP

Head, agricultural engineering dept.
University of Tennessee

The 1944 McCormick Medalist

(Continued from page 254)

neers. He was chairman of the College Division in 1926-27, chairman of the Power and Machinery Division in 1928-29, president in 1931-32. He represented the Society with notable success in the American Engineering Council, and at the close of its activities was its treasurer and a member of its executive committee.

Though he has written for farm and trade publications, and has given papers before other learned bodies, his main avenue of expression has been the A.S.A.E. and its journal, AGRICULTURAL ENGINEERING, in which latter an incomplete listing reveals 17 titles. He is currently a director of the Peoria Association of Commerce, chairman of the agriculture-industry committee of the Illinois Chamber of Commerce, committeeman on cooperation with education in the National Association of Manufacturers, member of the council of the Society for the Promotion of Engineering Education, a member of the committee on training and education for the industries of the American Society of Mechanical Engineers, and a member of the American Society of Tool Engineers.

A System for Checking Terraces

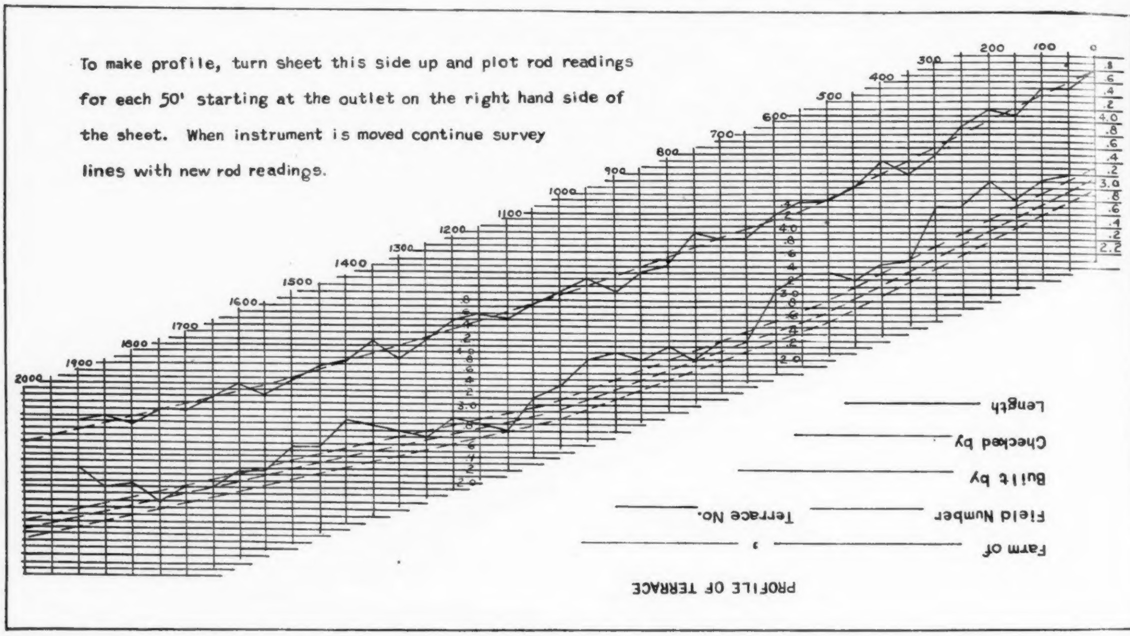
By J. C. Wooley

MEMBER A.S.A.E.

WHEN a terrace system has been completed, the channels are supposed to be built to a variable grade, starting at the outlet with 4-in fall per 100 ft and decreasing to 3 in, 2½ in, and 2 in per 100 ft at the upper end. The importance of having terraces built to exact grade increases as the permeability of the soil decreases. A pond 2 in deep in a terrace channel on open soil would perhaps do no harm but on a tight soil it would drown out crops and inter-

This paper was prepared expressly for AGRICULTURAL ENGINEERING.

J. C. WOOLEY is professor of agricultural engineering, University of Missouri.



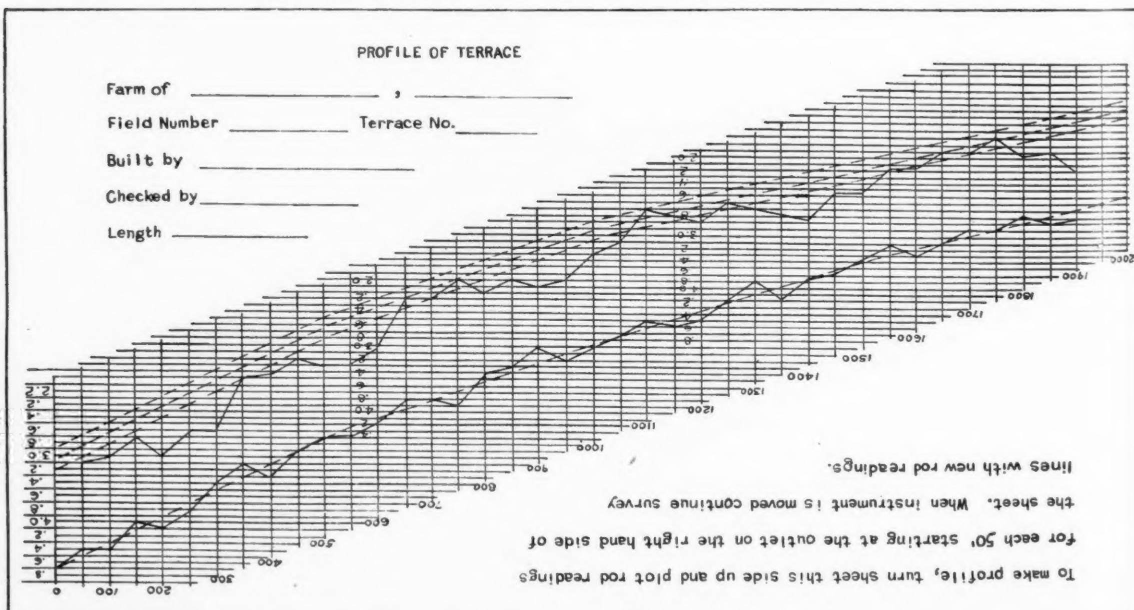


Fig. 1 (Above) Terrace profile chart in position for plotting rod readings as taken • Fig. 2 (Below) A profile of the terrace. The dotted lines show the ideal terrace channel, and the three lines at the top show ideal heights for the ridge on slight, medium and steep slopes. The irregular line represents a terrace that had just been completed. It shows several points where cuts up to 4 in should be made and where slight fills will be needed to prevent ponding. There are four places on the ridge where fills would be desirable to bring the terrace up to specification. The length of the terrace, in the terrace profile chart, is shown to be 1900 ft

fere with field operations throughout many seasons.

The statement is often made "Ponds will do no harm; they will soon silt in and bring the terrace to grade". These are consoling statements to the careless builder, but years of experience have proven that there is usually so little soil movement between terraces that the ponds will be there for a decade unless something is done to correct the grade. If there is appreciable soil movement between terraces as might be true in case of poor soil management or too wide spacing, then the deltas built in the channel are more often the cause of ponding than a remedy for it.

The time to avoid ponding is at the time of construction. It has been found that a check on grades when the terrace is one-half completed will enable the builder to correct any errors and not add to the time required in building. If the terrace is to grade when half completed, then by maintaining uniform cuts throughout its length the completed job will need but little attention. This does not imply, however, that the final check can be omitted nor final corrections made to bring the channel to grade and the terrace up to standard specifications.

The final proof of completion of the job is a profile of each terrace in the system. To do this in the ordinary manner requires a survey with computation of elevations, etc. This requires time and equipment not usually available in the field. To overcome this difficulty the system described in this article has been developed and is now being used by a number of contractors in the state.

Fig. 1 shows the chart in the position for plotting the rod readings as they are taken. The first rod reading is taken in the channel at the outlet and plotted, starting on the right-hand side of the chart. As soon as this rod reading is known, the vertical scale can be written in on the right-hand side of the chart. (Each line represents 1 in or 0.1 ft. The lower rod readings will be at the bottom of the chart.) A reading on the ridge will have a lower rod reading and is plotted below the channel reading. Readings are taken each 50 ft and plotted direct. If there are high or low spots between these stations, they can be plotted in at the proper place.

By turning the chart (Fig. 1) the other side up, you have a profile of the terrace (Fig. 2). It gives the length of the terrace and the height of the ridge in relation to all points affecting it, and it tells where corrections must be made and how much. It will be evident as the rod readings are being plotted as to the points where work will be needed. These can be marked and there will be no loss of time in finding them when the correction is to be made. These profiles serve as a basis for settlement in case terraces are contracted and form a valuable record for the farmer.

The 1944 John Deere Medalist

(Continued from page 254)

In 1915 Mr. Ramser began studying the engineering factors involved in land terracing. One of the things he brought forth was the idea of the variable-grade terrace which made possible a progressively greater capacity, to handle increasing amounts of water, without change in terrace size. So sound were his early findings that his USDA Department Bulletin 512, dated 1917, still forms the basis for terracing practice, despite much subsequent research which has altered but little his original recommendations.

Equally great in practical value as the genius of his research has been the promptness and the profusion with which he has prepared and published his work, that his colleagues might make full use of it. A list of bulletins and reports of which he is author, coauthor or director consists of 32 items, while a similar listing of technical articles in sundry engineering and scientific publications comprises 58 entries. Some 16 of the latter were contributions to the meetings, the journal, or the transactions of the American Society of Agricultural Engineers.

Mr. Ramser has been a member of the American Society of Agricultural Engineers since 1924, and was chairman of its Soil and Water Division during the 1936-37 term. He served as a member of the Council of the Society for the 1937-40 period. Other of his memberships include the American Society of Civil Engineers, American Association for the Advancement of Science, American Geophysical Union, and the Cosmos Club of Washington, D.C.

The Postwar Farm Tractor

TO THE EDITOR:

I HOPE to resume my work in agricultural engineering after the war, specializing in farm power and machinery. I wish to offer two suggestions for consideration in connection with the postwar tractor and farm machinery:

1 Have as many types of implements as possible as attachments to the tractor, such as cultivators, seeders, plows, one-way disks, and combines. These implements should be easily attached to or disconnected from the tractor and should be propelled and powered by the tractor engine. There should be attachments for all sizes of tractors, and tractors of the same size but of different makes should have attachments interchangeable.

2 Those implements which cannot be readily attached to tractors, such as wagons, should be equipped with standard universal wheels and tires which are interchangeable from one implement to another, so that the farmer will require only one set of wheels and tires for all his drawn implements as he will probably not be using more than one implement at a time. Also, he will make more efficient use of his tires in this way since tires not used to produce traction seldom wear out on farm machinery, but rather deteriorate with age.

L.A.C. FRED W. KERNEN

RCAF.

Brush Removal for Pasture Improvement

(Continued from page 253)

the original grass cover is more dense where small amounts of shade from woody vegetation exist. For this reason, full grass production will be obtained more rapidly and erosion more completely controlled if only land with light and medium brush infestation is cleared. On such land from one to three years are usually required after clearing, for the grass to become fully developed.

In general the cost of clearing operations must be kept at a minimum because returns from most of the land, in a reasonable length of time, will not justify a large expenditure. The answers to this problem might be found in the adaptation of simple practical equipment suitable for operation on a farm tractor. In some cases larger or more expensive equipment may be used on a contract basis or through group effort.

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Common Denominator

(Continued from page 247)

which need not be mentioned now, it demonstrates the peculiar position of agricultural engineering as a common denominator not only of many phases of engineering but of science, sociology and economics.

As America becomes increasingly an urban and industrial nation, its science and engineering will tend more and more to proceed from urban backgrounds to urban objectives. For the sake of the city as well as of the country it will be more necessary as well as less instinctive to dovetail the farm and the land more definitely into the over-all scheme of things. Not only will this be part of the work of the individual engineer. It will be necessary for agricultural engineers as a profession to be accessible and articulate if they are to be consulted by other great sectors of population. That, it would seem, is the duty and destiny of this Society.

NEWS SECTION

A.S.A.E. President for 1944-45

RUDOLPH Henry Driftmier, head of the department of agricultural engineering at the University of Georgia, is the new president of the American Society of Agricultural Engineeers, and will hold office for one year from the close of the Society's 37th annual meeting at Milwaukee last month. He succeeds Arthur W. Turner, educational adviser of the International Harvester Co.

R. H. DRIFTMIER

Professor Driftmier is a native of Clarinda, Iowa, educated in the rural and high schools of that community, and at Grinnell and Iowa State colleges; also Kansas State College where he earned the postgraduate degrees of M.S. and A.E. For a decade starting in 1920 he was on the faculty at Kansas, advancing from instructor to professor of agricultural engineering.

Since 1930 he has been professor in charge of the department of agricultural engineering at the University of Georgia at Athens. He also has served as engineer in charge of construction and maintenance for the college of agriculture therein, and later as supervising engineer and head of the department of construction and maintenance for the Regents of the University System of Georgia. In 1943 he was given the added assignment of head of the department of plant operations of the University.

At Kansas he taught farm power and machinery as well as sanitation and water supply, farm buildings and equipment. At Georgia he has supervised all phases of agricultural engineering instruction and extension, but in his own teaching has specialized somewhat in farm buildings and equipment, as well as the technology of structural design.

In World War I Mr. Driftmier enlisted in the 67th Artillery, Coast Artillery Corps, and saw six months service in the AEF. Later he was a post commander of the American Legion in Kansas. In the American Society of Agricultural Engineers he already has served as councilor, vice-president, chairman of the College Division, and chairman of the Southeast Section.

A.S.A.E. Meetings Calendar

December 11 to 13 — Fall Meeting, Stevens Hotel, Chicago.

A.S.A.E. Committee Endorses Farm Safety Week

DURING a recent meeting of the Committee on Farm Safety of the American Society of Agricultural Engineers, the following resolution was prepared and adopted: "The A.S.A.E. Committee on Farm Safety endorses National Farm Safety Week, July 23 to 30, 1944, as a means of emphasizing farm safety, and it further recommends and urges that the Society as an organization, as well as all agricultural engineers individually, assume responsibility to do what they can to make it effective by more active participation in farm safety work."

This resolution was presented by the Committee at the annual business session of the Society held at Milwaukee June 19, when formal approval of it was voted.

(News continued)

Nearly 250 A.S.A.E. members and guests attended the Society's annual dinner at the Hotel Schroeder in Milwaukee on June 21

Wirt Reports on Jefferson Committee Activity

THE representative of the American Society of Agricultural Engineers, F. A. Wirt, on the National Agricultural Jefferson Bicentenary Committee, has reported on attendance at a meeting of the Committee held in Washington on June 26. At this meeting certain recommendations were adopted in principle, which include (1) naming the auditorium of the U. S. Department of Agriculture the "Jefferson Auditorium," (2) a project to establish a Jefferson memorial park at Charlottesville, (3) a proposal for a national agricultural museum, (4) development of courses in the history of science in agriculture, (5) acquisition by the Department of Agriculture of oil portraits of Washington, Jefferson, and Lincoln, the three great Americans whom it has honored for their contributions to American agriculture, and (6) preparation of the Jefferson exhibit for availability on loan to interested institutions throughout the country.

Mr. Wirt pointed out at the meeting of the Committe the great need today of giving millions of Americans a better conception of the problems of agriculture; he stated specifically that while industrial and business interests were making substantial contributions to promote a better understanding of agriculture generally, the U.S. Department of Agriculture and the land-grant colleges and universities have a responsibility in this respect that no other group can assume.

At this meeting the A.S.A.E. was specially commended for its cooperation with the Jefferson Committee. Attention was also called at the meeting to a new publication, entitled "Thomas Jefferson, Soil Conservationist," issued as Miscellaneous Publication No. 548 of the U. S. Department of Agriculture, the author of which is Dr. Hugh H. Bennett, chief of the Soil Conservation Service. Soil-conservation-minded persons will be particularly interested in this publication.

New A.S.A.E. Appointments

NEW appointments to the divisions of the American Society of Agricultural Engineers were announced by the new Society president, R. H. Driftmier, at its annual meeting at Milwaukee last month. These include Dr. E. G. McKibben, Michigan State College, as the new vice-chairman of the Power and Machinery Division; Clarence J. Hurd, Tennessee Valley Authority, as vice-chairman of the Rural Electric Division; Roland A. Glaze, Weyerhaeuser Sales Co., vice-chairman of the Farm Structures Division, and Henry J. Barre, Purdue University, as vice-chairman of the College Division. At this writing President Driftmier has not announced the appointment of the new vice-chairman of the Soil and Water Division.

Earl D. Anderson, Republic Steel Corp., has been appointed by President Driftmier as the chairman of the Meetings Committee for 1944-45. Mr. Anderson together with the following division chairmen will constitute the personnel of the Society's Meetings Committee for the ensuing year: Ben G. VanZee, Power and Machinery Division; W. D. Hemker, Rural Electric Division; Deane G. Carter, Farm Structures Division; Howard Matson, Soil and Water Division, and George B. Nutt, College Division.

Personals of A.S.A.E. Members

G. W. Giles, associate professor of agricultural engineering, North Carolina State College, has recently been devoting his teaching time to the teaching of diesel engineering in the U. S. Navy Officer's Training School located at that institution. North Carolina has recently completed a \$200,000 building and the USN Bureau of Ships has installed \$2,000,000 worth of diesel engines and equipment to make it the most modern and complete diesel teaching laboratory ever assembled in the world.

Roy W. Godley who has been serving as agricultural counsellor for Monongahela West Penn Public Service Co., at Parkersburg, W. Va., has been transferred to the home office at the company in Fairmont, to head the rural department in which position he will formulate and correlate the agricultural activities of his company.

R. E. Jezek has been transferred from the USDA Emergency Rubber Project (kok-saghyz machinery investigations at Beltsville, Md.) to the Department's tillage machinery laboratory at Auburn, Ala., where he will be engaged in developing experimental equipment for the gathering and harvesting of tung nuts. Recently he was promoted from assistant agricultural engineer to associate agricultural engineer.

Aldert Molenaar has been transferred from his position as water utilization technician, Bureau of Agricultural Economics, USDA, to the Farm Security Administration, where he will be engaged as project engineer in the Rathdrum Prairie Irrigation Project in northern Idaho, which is a Wheeler-Case land development project.

Harry B. Roe retired June 30 to become professor emeritus of agricultural engineering at the University of Minnesota. His re-

First reports from Farmers on Texaco's new "RUST KILLER"

A COATING of Texaco Rustproof Compound applied to the knives and ledger plates on the cutter bar of a mower at the end of the season insures complete all-winter protection — maintains the sharp cutting edges of the knives.

LAST Fall, a number of leading farmers in various parts of the country whose names were suggested by Agricultural Engineers, were given samples of Texaco Rustproof Compound to test.

First reports of these tests, just received, more than confirm the results of the tests conducted at a number of Agricultural Colleges.

A few typical comments follow:

All-Winter Plow Test

"This product is certainly worth every cent it costs and more. I have been using it on all types of machinery — drills, discs, combine and mower. It is a sure way to keep off rust. I can tell you it really is a pleasure to go into the field with a moldboard plow and just start plowing without the troublesome worry of getting the moldboard to scour. I let my plow stand out all last winter to test the compound, and when I started plowing this spring, it worked perfect. Since the war I cannot get aluminum paint to go on tin, on barns, etc., and find this compound a very satisfactory substitute. You are welcome to use my name, because I would like to help that much toward getting farmers acquainted with it. It is certainly worth many times its cost price on the farm."

G. W. Crow, Wagoner, Oklahoma

"I have found Texaco Rustproof Compound to completely prevent rust where applied. It is most excellent to preserve highly polished surfaces which rust readily, such as plow moldboards, knotters and knives. This Rustproof Compound if used extensively will save farmers lots of time, trouble, delays and money."

Harry Boober, Urbana, Ohio

Keeps Sickle Guards Bright

"Texaco Rustproof Compound has no equal, we find, for preserving the brightness of the sickle guards of mowers, binders and combines. We want to express our appreciation for a product designed for a specific job and which does it so well."

J. Leo Abart, A.E., Dow City, Iowa

Applied on the moldboard of a plow that was stored outdoors, in a test at a leading Agricultural College, Texaco Rustproof prevented rust for 561 days.

For further information and literature on Texaco Rustproof Compound, write nearest Texaco office listed below.

IT BEATS THE WEATHER TO MAKE FOUR BIG SAVINGS

Texaco Rustproof Compound is NEW. 1. It prevents rust formation. 2. It penetrates rust and stops further rusting. 3. It loosens rust so that it's removed easily. (A second coating keeps rust off.) It saves time, labor, money and metal.

Available in 5 and 25 pound cans and 100 pound drums

THE TEXAS COMPANY

WIN THE WAR ON WEAR WITH TEXACO PRODUCTS FOR THE FARM

DISTRICT OFFICES: Atlanta 1, Ga.; Boston 17, Mass.; Buffalo 3, N. Y.; Butte, Mont.; Chicago 4, Ill.; Dallas 2, Tex.; Denver 1, Colo.; Houston 1, Tex.; Indianapolis 1, Ind.; Los Angeles 15, Calif.; Minneapolis 2, Minn.; New Orleans 6, La.; New York 17, N. Y.; Norfolk 1, Va.; Seattle 11, Wash.

tirement from active engineering work, however, was short lived, as he is now employed as associate civil engineer in the division office of the U. S. Army Engineer Corps at Portland, Ore., where he will be engaged in economic studies in the Army's Columbia River basin development project.

John A. Schaller, agricultural engineer, agricultural engineering development division, Tennessee Valley Authority, is one of the authors of agricultural engineering publication No. 6, entitled "Barn Hay Driers: Basic Principles of Design, Operation and Management" recently issued by that agency.

Edward A. Silver joined the Oliver Farm Equipment Company in a research capacity last September, and as of June 1 he was appointed director of research to organize and head up an agricultural research department at company headquarters in Chicago. For a period of 16 years prior to joining the Oliver organization, he was a member of the agricultural engineering staff at the Ohio Agricultural Experiment Station, and during the past year served as acting chief of agricultural engineering at that station.

Frank E. Watts, executive assistant of "Farm Journal" specializing in farm electrification studies, announces the establishment of the "Rural Electrification Information Exchange," the function of which will be to collect, analyze, and index all information available on the uses of electricity on the farm. Headquarters for this service will be the New York offices of "Farm Journal" at 420 Lexington Ave., New York 17.

Applicants for Membership

The following is a list of recent applicants for membership in the American Society of Agricultural Engineers. Members of the Society are urged to send information relative to applicants for consideration of the Council prior to election.

Louis Adams, agricultural sales manager, Allis-Chalmers Mfg. Co. (Mail) 1127 Kavanaugh Place, Wauwatosa, Wis.

A. W. Bakken, junior account executive, The Buchen Co. (Mail) Box 182, Northbrook, Ill.

Lloyd E. Bissell, general manager, Fleury-Bissell, Ltd., Elora, Ont., Canada.

Roy G. Brandt, junior engineer, Harry Ferguson, Inc., Dearborn, Mich. (Mail) 6525 Barrie.

John I. Cantral, designer, John Deere Plow Works, Moline, Ill. (Mail) 1828 12th Ave.

Francis E. Charles, associate editor of "The Furrow," advertising department, Deere & Co., Moline, Ill.

J. M. J. Dominguez, engineer, Agronomoy Pecita Quimico Azucarero. (Mail) Villvendas No. 9, Jovellanos, Cuba.

G. B. Duke, designing engineer, John Deere Harvester Works, East Moline, Ill. (Mail) 1215 15th St.

J. C. Dykes, assistant chief, Soil Conservation Service, USDA. (Mail) 4511 Guilford Road, College Park, Md.

Robert A. Fletcher, 1st Lt., Ordnance Dept., USA. (Mail) 604th Ord. Bn., APO 555, c/o Postmaster, New York, N. Y.

Leon A. Hawkins, farm practice research, International Harvester Co., 180 N. Michigan Ave., Chicago, Ill.

Clarence A. Hubert, chief engineer, farm tractor engineering, International Harvester Co., Chicago, Ill. (Mail) 9551 So. Bell Ave.

C. A. McDade, owner, C. A. McDade Co. (distribution of farm electrical equipment), 6526 Hamilton Ave., Pittsburgh 6, Pa.

John G. McGraw, manager, power machinery dept., Deere & Webber Co., Minneapolis, Minn. (Mail) 2958 Upton No.

Richard E. Moroney, managing editor of "The Business of Farming," United States Gypsum Co., 300 W. Adams St., Chicago 6.

Paul J. Newton, treas. and gen. mgr., Hertzler & Zook Co.; consultant, New Holland Machine Co. (Mail) 642 Electric Ave., Lewistown, Pa.

John S. Palmer, mechanical engineer (refrigeration), International Harvester Co., 2626 W. 31st Blvd., Chicago 8, Ill.

W. T. Pound, chief engineer, Fleury-Bissell, Ltd., Elora, Ont., Canada.

Ernest F. Roeseler, engineer, J. I. Case Co. (Mail) Box 160, RR 4, Kenosha, Wis.

Raymond E. Smith, manager, research and development dept., Wincharger Corp., East 7th & Division Sts., Sioux City 6, Iowa.

B. H. Standley, supervisor of agriculture department, Houston Lighting and Power Co., Houston, Tex. (Mail) 527 West 30th St.

R. R. Wagner, chief draftsman, Starline, Inc., Harvard, Ill. (Mail) 203 W. Burbank St.

PROFESSIONAL DIRECTORY

New Literature

"MEET THE FARMERS," by Ladd Haystead, farm columnist of "Fortune" magazine. Cloth, 5 x 7¾ inches, 221 pages, \$2.50. G. P. Putnam's Sons, New York, N. Y.

Subtitled "A Personal Introduction to Thirty Million Americans," this book is intended to bring clarification and understanding to what has been a confused and confusing picture. It undertakes to reveal farmers as they really are, the daily lives, folk lore, and superstitions of and about farmers, and explodes many misconceptions held not only by city people but by many of the self-appointed farmers' spokesmen. The book presents a fresh point of view out of which comes a new understanding of agriculture and a desire to cooperate intelligently with the farmers to the end that industry, business, and agriculture can move forward together to a better peace and a happier and an economically sound America in the future.

"THE OXY-ACETYLENE HANDBOOK," a manual on oxy-acetylene welding and cutting procedures. Cloth, 6¼x9½ inches, 600 pages, 405 illustrations, \$1.50. The Linde Air Products Company, unit of Union Carbide and Carbon Corp., New York 17, N. Y.

This book has been planned to be a basic handbook or manual on oxy-acetylene welding and cutting and ther related processes. It has been planned specifically to be of use in colleges, vocational schools, and secondary schools, and in other teaching institutions having courses in welding, instruction methods, shop, and other vocation and technical subjects. The book will also be of interest to those in industrial plants who are responsible for the training of welding and cutting operators. It will be of use to plant management people, engineers, designers, superintendents, foremen, and operators in shops where the oxy-acetylene processes are or might be used as production or maintenance tools. The book covers the entire range of the oxy-acetylene process, giving clear, easy-to-follow instructions for handling all the common commercial metals, together with simple explenations of the fundamental principles of the various methods of depositing and controlling molten metals. Considerable space is devoted to an explanation of the operating principles of oxy-acetylene equipment and instructions for its care and maintenance.

EMPLOYMENT BULLETIN

The American Society of Agricultural Engineers conducts an employment service especially for the benefit of its members. Only Society members in good standing may insert notices under "Positions Wanted," or apply for positions under "Positions Open." Both non-members and members seeking to fill positions, for which ASAE members are qualified, are privileged to insert notices under "Positions Open," and to be referred to members listed under "Positions Wanted." Any Notice in this bulletin will be inserted once and will thereafter be discontinued unless additional insertions are requested. There is no charge for notices published in this bulletin. Requests for insertions should be addressed to ASAE, St. Joseph, Michigan.

POSITIONS OPEN

DEVELOPMENT ENGINEERS AND DRAFTSMEN for agricultural equipment wanted for plant in Middle Atlantic Section. Factory in region almost devoid of equipment manufacturing but with excellent marketing possibilities for certain badly needed new products. Good salaries will be paid in proper proportion to experience and ability. In writing please give full account of education, experience, qualifications, draft and family status, and present salary. Include photograph if possible. PO-162

EMPLOYMENT BULLETIN

(Continued from page 270)

AGRICULTURAL ENGINEERS, preferably with some extension experience in farm structures, wanted by a nationally known manufacturer of building materials to do educational, research and promotional work for districts in New York, Chicago and New Orleans. Excellent opportunity for permanent postwar connection with a well-established, substantial manufacturing organization. Salary open. State education, experience, draft status and geographical preference in first letter. PO-161

RURAL DEPARTMENT MANAGER wanted for permanent employment with an eastern electric utility. Immediate opening for competent college-trained, agricultural engineer with experience in modern business promotional sales methods. Familiarity with Pennsylvania-German farmer customs desirable. Salary open. Write fully. PO-160

AGRICULTURAL ENGINEER with irrigation engineering experience in Italy or with experience under comparable conditions in the southern part of United States is wanted by a federal government agency. Applications should not be in draft classification in which they are likely to be called. A highly competent man able to advise local government authorities concerning the relative urgency of various engineering projects is wanted. Write giving full particulars in first letter. PO-157

REGIONAL SERVICE MANAGER seeking postwar security is wanted by well-known, fast-growing manufacturer of farm tractors and implements who is expanding his organization to prepare for postwar opportunity. Man needed to contact distributors to see that factory service policies are inaugurated and followed through. Must be able to command respect; must know farm implements, their use, care and maintenance and be able to pass his knowledge on to others through meetings, training and supervision. Probably college trained with practical experience; married, and between the ages of 30 and 45. Salary open. Write in confidence to Director, Council for Market Development, 1404 Maccabees Bldg., Detroit, Mich.

FARM EQUIPMENT ENGINEERS. National merchandising organization planning large farm equipment program has openings for senior and junior design engineers. Write experience, draft status, salary expected. Replies confidential. PO-155

ENGINEER interested in drainage research wanted. Southern state with large acreage needing drainage plans to begin intensive research program. First letter should give training, experience and references. PO-153

RURAL ELECTRIFICATION SPECIALIST wanted by agricultural college for combination research and extension work. A very progressive southern state with outstanding rural electrification program. Salary commensurate with training, experience and ability. PO-152

AD COPY WRITER wanted. Man with some technical experience who is creative and has the knack of writing simple, forceful copy for industrial and technical advertising is desired. Permanent position and good opportunity for advancement with long-established 4-A advertising agency. Correspondence will be kept confidential. PO-146

ENGINEERS WANTED in our plants in CALIFORNIA, FLORIDA, ILLINOIS and other states. Must have had at least three years' experience in general machine design. Our work is postwar development of machines for use in agriculture and in fruit and vegetable canneries, packing houses, and processing plants. Please give full history, including family, also name of state in which you prefer working, and salary expected — also snapshot of yourself if available. Reply to Food Machinery Corp., San Jose, California.

POSITIONS WANTED

AGRICULTURAL ENGINEER (B. S. in horticulture, B. S. in engineering and M. S. in agricultural education) with 25 years of experience in teaching, extension and research directly in the field of agricultural engineering, and at present extension agricultural engineer and department head, wishes a position where his training and experience will have an outlet in developing a full four-year curriculum, postwar rehabilitation courses, vocational-agriculture training courses, or opening new lines of approach in extension or research. Special ability in visual methods of presenting extension material and in the organization of cooperative extension programs. PW-359